

# ON THE VEGETATION OF MALAYSIA.

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(Plates I.-IX.)

The following essay being meant for the European residents of the Straits Settlements, technicalities are avoided, and explanations given which would not be necessary if it were addressed to a strictly scientific class of readers. In the absence of any published description of the flora, the figures given must be understood to be approximate only. The whole review of the vegetation is founded on my own observations aided by collections made in company with the Rev. B. Scortechini, or during my own subsequent travels.

Though the essay is said to be confined to the flora of Malaysia and deals principally with what may be considered the very heart of the region, it must be borne in mind that some portions of it are little known. Yet in a general way the floras of the countries around are well-known. Thus we are fairly well acquainted with the flora of Burmah as well as that of Siam, Cochin China, Cambodia or Tonquin. The Australian region to the south is as well known as any in the world. New Guinea has recently disclosed some of the secrets of its vegetation; therefore a general review of the flora of Malaysia ought to be easy to make without much risk of error.

**GEOGRAPHICAL LIMITS.**—Of the Malay Peninsula no more is here included than the portion south of lat.  $5^{\circ} 30'$  N. This is its broadest part and includes many varieties of soil and climate. A few preliminary words are necessary as to—(1) The Physical Geography; (2) Geology; (3) Climate of this region.

The Malay Peninsula is covered with ranges of mountains running parallel with the general trend of the land. There are two systems of mountains; one running through the centre and forming a watershed between the east and west coasts; the other a broken series of ranges lying between the main range and the sea. The first mountain chain is the highest. It increases in extent and height towards the wider parts of the land, and many of its summits reach elevations of from 8,000 to 10,000 feet. It gradually declines from the interior of Perak, and after passing through the state of Malacca it subsides to the level of the sea in the island of Singapore.

The second range parallel with this consists of two or three parallel ranges. They do not form a watershed. There are several gaps and intervals between them through which rivers pass. These ranges rise to a height of between 5,000 and 6,000 feet. Some of them border almost on the very edge of the sea.

The geology of this region is very simple. The basis of the whole is granitic. This is overlaid in places by schists and slates, which, on the coast, where exposed to marine action, have decomposed into a reddish deposit called Laterite. The schists and slates contain large quantities of iron, forming purple, red, and brightly variegated strata. The Laterite, therefore, is a hydrated per-oxide of iron with clay, or Limonite. At the junction of the granite with the schists or Laterite, tin occurs, forming some of the richest mines of stream tin in the world. The main range is probably in its highest portions largely composed of schists. There are besides this a number of isolated outliers of crystalline limestone retaining traces of stratification. These form abrupt and precipitous mountain masses of limited extent, from 1,500 to 2,000 feet high. They do not contain fossils; but in Borneo similar masses contain Devonian fossils, and therefore it is probable that this is the age of the strata in the Malay Peninsula. There is scarcely any development of volcanic rocks on the western side, though I have seen a recent basaltic dyke in one place. But on the eastern side, half-way between the mountain range and the



sea, there are some andesitic ranges very similar to the Andesite rocks of the Philippine Islands.

Along the sides of the rivers are alluvial plains of limited extent but considerable depth. They consist of strata of alluvium from the neighbouring mountains, enclosing large stems, branches, and roots of trees of existing species.

The climate of the region is one of the warmest and most moist of the tropics. There are many countries even outside the tropics where the temperature has a higher range, but the peculiarity of this is that the mean temperature is perhaps a little above  $85^{\circ}$  and that there are no seasons, no winter and no summer, or any period distinctly marked with periodical rains. Storms and disturbances of the atmosphere are almost confined to daily thunderstorms, sometimes of great violence, while gales of wind are of rare occurrence. The air is cloudy and misty, which moderates the excessive heat. The alternate north-east and south-west monsoons are felt, but scarcely more than felt. The average number of rainy days is said to be about half the year, while the mean rainfall is about 100 inches. The west coast, if subject to any remarkable change, is so from the visitations of certain squalls called Sumatras (as they are supposed to come across the Straits of Malacca from that island), but they are of short duration though violent.

The rivers run north and south, parallel with the main range, and eventually turn to the coast, and those which run a short course flow east and west of the watershed. Of the former there is on the west side the Perak River with its large tributaries the Plus, Kinta, and Batang-Padang. On the eastern side of the range there is an almost similar course taken by the Pahang and its tributaries. Both these rivers are supposed to drain an immense area, which is variously computed at between 4000 and 6000 square miles, but about which no accurate measurements can be given. The other chief streams on the west coast are the Bernam, Selangor, Langat, Klang, Linggi, Moar, and the Johore, the estuary of which faces Singapore. Between the Pakshan

(the lower course of which separates the Peninsula from Tenasserim in British Burmah) and the rivers Muda and Krian there are none but small streams. On the east side there is the Endau, the Pahang with its large tributaries, the Kuantan, the Besute, the Kelantan, and the Patani. The short rivers which flow east and west of the dividing range have their channels through marshy grounds, and their estuaries amid low mangrove islands. This is a feature which affects the vegetation of the region. Mangrove flats are well-marked areas in the vegetable kingdom. They fringe almost all the west coast of the Peninsula and a good deal of the east. They represent long periods of erosion on the mountain ranges. The heavy rains have, for ages, been washing away piecemeal the mountain axes of the country. These have been gradually lowered, and the land extended in the form of shallow mud flats of alluvium of considerable depth. The marshy soil has thus encroached on the Straits of Malacca and rendered them very shallow. Thus a fringe of low-lying, flat mud islands lines the shores of Sumatra on one side, and the west coast of the Peninsula on the other. These regions have been described as unattractive, dreary places of the most unwholesome kind; but this is erroneous. The soils are perhaps the richest in the world. They are densely clothed with vegetation. When the tide is out they do not look attractive, but the islands have a rich and picturesque beauty of their own. The beautiful masses of dark green and lustrous leaves form groves of ever-changing aspect, while probably the great evils of malaria are mitigated by the absorbing power of these trees. When the tide is in, the beautiful masses of foliage contribute most admirably to adorn the water scenery.

References will be made to some of the larger islands of the Archipelago. To treat of them separately would exceed the limits of this paper. Most of them are only partially explored, that is, botanically explored, and others have but little individuality. This region is the one above all which seems to offer the greatest results to botanical research. Take for instance Borneo, a country larger than England, Scotland, and Wales combined,

how much remains to be discovered amongst the solitary fastnesses of its interior forests.

CHARACTERS OF THE FLORA.—The portion of the vegetable kingdom of which this essay treats is the tropical Asiatic flora, but not all of it ; and, moreover, including certain outlying plants. The limitations will be understood from the following :—Amongst the included plants of the Malayan Peninsula and the Archipelago many will be found generally distributed over India, excepting the dry parched regions of western India. Many extend eastward to Chittagong and eastern Bengal, several to Ceylon, and a few to tropical Africa ; but none to central India. To the eastward many range over the South Pacific islands to North Australia ; a few are found to the northward on the Chinese coast, probably extending over Cochin China. On the north-eastern edges of the region occur plants of the Chinese flora reaching it through the Philippine Islands. There is a small and peculiar Asiatic element in the vegetation which extends northward to Shanghai and Japan. Besides these, there are plants of course of world-wide distribution which have been introduced in many cases from remote countries, and now are spread everywhere. A characteristic instance of this in a common and rather showy weed named *Turnera*, of the order TURNERACEÆ, is met on the roadsides near Singapore, Penang, and Malacca, besides the other native states. The genus is almost entirely American, one only out of 70 species being found at the Cape.

The connection of the flora with that of the Philippine Islands is most intimate, as nearly all the genera are represented in that group. The exclusively Philippine genera are very few and nearly always confined to one species, such as *Diplodiscus*, *Dasycoleum*, *Carionia*, &c. The relations of the region to Australia are less extensive ; but still the species common to both regions would make a list too long to be inserted here. They are chiefly tenants of the sea-coast, or common tropical weeds.

The best way to deal with the character of the flora as proposed in this essay will be first to describe generally its features, and then such subdivisions as arise from position, soil, climate, &c.

Numerically the Malayan flora is very rich in genera and species. Accurate figures cannot be given, but we may say that of dicotyledons there are about 1,000 genera and 3,000 species. Of monocotyledons 250 genera and say 1,000 species. This is a large proportion, the average being usually about one-fourth in tropical insular vegetation unless over very limited areas. But this estimate is founded on the opinion of more than one collector and botanist, and is borne out by the closely allied flora of the Philippines. The GYMNOSPERMÆ are poorly represented.

Having no accurate figures to go upon, I must depend in some measure upon the estimates that have been made of some of the neighbouring floras such as the Philippines, and particular islands as Java, Sumatra, Borneo, Celebes, &c. In the Philippines the proportion of vascular cryptogams to phænogamic vegetation is nearly one-eighth, chiefly ferns.\* Of these 52 species were not known from elsewhere at the time Mr. Rolfe wrote, or a proportion of one-tenth of the ferns indigenous to the Philippines. Since that time, however, the publication of Beddome's list of Scortechini's ferns,† and Hose's papers on collections of ferns made in West Borneo‡ has somewhat changed the numbers.

There is one peculiarity about the Malayan flora which must strike every observer, and that is the comparative absence of one

\* See Rolfe "On the Flora of the Philippine Islands." Jour. Linn. Soc. Botany, XXI. (1886), p. 283.

† "Jour. of Botany." Nov. 1887, XXV. p. 321, pl. 278.

‡ "Jour. Linn. Soc. Botany, XX. p. 222; XXIV. p. 256; also "Jour. of Botany, XXVI. p. 323. See also Cesati's Memoir in Vol. VII. of the "Atti dell' Accademia, delle Scienze Fisiche e Matematiche di Napoli;" J. G. Baker, "Jour. of Botany," VIII. p. 37 (1870), and Burck's paper in Vol. IV. of the "Annals of the Botanic Gardens of Buitenzorg," p. 88 (1884).

of the largest, the most distinct, most uniform, and therefore the most natural of all the flowering plants, namely, the COMPOSITÆ. The Malayan region is certainly influenced in some way so as to almost exclude the order from its vast forest-clad plains and hills. It is at once the poorest in COMPOSITÆ, and those genera which are seen are destitute of any interest or peculiarity. There is not a single endemic genus, and every one of the representatives of the order in Malaysia spreads more or less over the Indian continent. A large proportion are little more than weeds which spring up rapidly and thickly where a forest has been cleared, and cultivated ground abandoned. Amongst these are *Ageratum conyzoides*, *Elephantopus scaber*, *Spilanthes grandiflora*, *Crepis japonica*, *Blumea hieracifolia* (very common), and *Vernonia cinerea*. These are ubiquitous weeds; they have taken thorough possession of the waste places in Malaysia. Bentham, in his essay on the COMPOSITÆ, says that if the known COMPOSITÆ of the Indian Archipelago were reduced to our ordinary standard they would not probably extend beyond 110 or 120 species. Beccari's collection of Sarawak plants made in Borneo in 1849 contained only six COMPOSITÆ.

The principal genera of a higher grade of COMPOSITÆ prevalent in tropical Asia are *Vernonia*, *Blumea* and allies, *Conyza* and allies, *Grangea* and allies, Gnaphalioid Inuloideæ, and Senecioniideæ. No others can count ten species; the most remarkable among them being a few Mutisiaceæ (*Leucomeris*, *Dichoma*, *Ainsliea*, *Catamixis*, *Gerbera*), mostly allied to South African species. *Ainsliea* is a special type, the only genus of thistles which is chiefly tropical. But the Mutisiaceæ are thistles of a peculiar kind. There are three large tribes of COMPOSITÆ not found at all in the flora of Malaysia, though largely represented in America and South Africa. These are the Helenioideæ (*Gaillardia*, *Tagetes*), Calendulaceæ (Marigolds) and Arctotideæ. Yet there are some introduced weeds of this order.\*

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\*See Bentham, "On the Classification, History and Geographical Distribution of Compositæ." Jour. Linn. Soc. Botany, XIII. (1873) p. 547.

## DICOTYLEDONS.

Amongst these certain genera occupy a leading position and give a character to the whole flora. These are shown in the following catalogue. The genera of sedges and some of the insignificant weeds, rushes, grasses, &c., are not included in the estimate.

LEGUMINOSÆ:—Large genera : *Desmodium*, *Crotalaria*, *Cassia*, *Bauhinia*, *Indigofera*, *Flemingia*, *Dalbergia*, *Pterocarpus*, *Cæsalpinia*, *Derris*, *Pithecolobium*.

Endemic genera :\* *Mecopus*, *Phylacium* (Arch.), *Abauria* (B.), *Amherstia* (Ten.), *Pahudia* (Arch.), *Sindora* (M.P.).

URTICACEÆ:—The genus *Ficus* is beyond all question the most thoroughly characteristic of the Malayan flora, numbering formerly between 400 and 500 species, but since Dr. King's revision reduced to 207. They are trees or shrubs with milky juice, alternate leaves with varied shape, the leaf-buds covered by deciduous leaf-scales. The fruits or figs are called receptacles, closed at the mouth by numerous scales in rows; the base narrow, with bracts, sessile or pedunculate, in pairs in the axils of the leaves or of the scars of fallen leaves. Dr. G. King,† whose observations have been made almost exclusively on Indo-Malayan and a few Chinese species, has arranged them in seven sections, of which, leaving out the technical detail, the following are the characters:—(1) *Palæomorphe*: small trees and erect or subscandent shrubs. (2) *Urostigma*: usually trees or powerful climbers; epiphytal at least in early life; leaves alternate, entire, coriaceous, rarely membranous; receptacles in the axils of the leaves or of the scars of fallen leaves, with three bracts at the

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\*The following letters after the genus represent the locality in which it is found:—M.P. Malay Peninsula, S. Sumatra, J. Java, B. Borneo, C. Celebes, Mol. Moluccas, Ten. Tenasserim, Arch. Malay Archipelago.

† "Observations on the genus *Ficus* with special reference to the Indo-Malayan and Chinese species," Jour. Linn. Soc. Botany, XXIV. (1887), p. 27.



base. This is the largest and most characteristic section. In no other is the tendency to be epiphytal at all strongly marked; in *Urostigma* it is universal. Many species in other sections are scandent and support themselves on trees and rocks by throwing out rootlets from their stems and branches. But these rootlets are furnished with fibrillæ and collecting-hairs like the roots that penetrate the soil, and are very different in appearance from the strong sub-divisions of the main axis by which the epiphyte embraces and ultimately strangles the tree to which it attaches itself. One constantly meets in the jungle fig-trees of this section, the stem of which is a perfect lattice of sub-divisions, the tree round which they were formed having entirely disappeared. (3) *Synœcia*: climbers with large coloured receptacles, the leaves tessellate beneath. (4) *Sycidium*: shrubs, small trees, or climbers; rarely epiphytal; leaves alternate; receptacles small, axillary and more or less scabrid. (5) *Covellia*: shrubs or trees; never epiphytes or climbers; receptacles on long sub-aphyllous branches issuing from near the base of the stem, often sub-hypogæal or on shortened tubercles from the stem and larger branches, or axillary. (6) *Eusyce*: scandent or erect shrubs or small trees; rarely epiphytal, leaves alternate, softly hairy, not scabrid or hispid; receptacles usually small, axillary. (7) *Neomorphe*: trees rarely scandent, never epiphytal: receptacles often very large, in fascicles from tubercles on the trunk and larger branches.

*Ficus hispida*, L., is one of the commonest species throughout tropical Asia and extends to North Australia and Hong Kong. It is also very variable, the variability being due in a great measure to the different situations in which it grows. This species bears the receptacles in pairs in the axils of the leaves, or in clusters on the trunk, and sometimes they appear in both positions on the same tree at the same time. The fruit from the trunk sometimes burrows in the ground. Other species have dimorphic receptacles, but this dimorphism bears no relation to the separation of the sexes.

Other large genera are *Celtis*, *Artocarpus*, *Pilea*, *Pouzolzia*.

Endemic : *Sloetia* (Arch.), *Parartocarpus* (B.).

RUBIACEÆ :—Large genera : *Hedyotis*, *Mussaenda*, *Randia*, *Gardenia*, *Ixora*, *Morinda*, *Psychotria*, *Spermacoce*.

Endemic : *Creaghia* (M.P.), *Mussaendopsis* (B.), *Lerchea* (Arch.), *Lucinsea* (Arch.), *Coptophyllum* (S.), *Trisciadia* (M.P.), *Aulacodiscus* (M.P.), *Lecananthus* (Arch.), *Gonyanera* (S.), *Praravinia* (B.), *Morindopsis* (M.P.), *Jackia* (M.P.), *Rennellia* (M.P. & S.), *Amaracarpus* (J.), *Gynochthodes* (Arch.), *Tetralopha* (B.), *Prosephalum* (J.), *Cleisocratera* (B.), *Mesoptera* (M.P.), *Litosanthes* (J.), *Myrmephytum* (C.)

EUPHORBIACEÆ :—Large genera : *Euphorbia*, *Phyllanthus*, *Antidesma*, *Croton*, *Acalypha*, *Mallotus*, *Macaranga*, *Excoecaria*.

Endemic : *Scortechinia* (M.P. & B.), *Chloriophyllum* (Arch.), *Paracroton* (J.), *Sumbavia* (Arch.), *Chloradenia* (J.), *Coccoceras* (M.P.), *Polydragma* (M.P.), *Cheilosa* (J.), *Cephalomappa* (B.), *Cladogynos* (C.), *Epiprinus* (M.P.), *Megistostigma* (M.P.).

MYRTACEÆ :—Large genera : *Beckea*, *Eugenia*, *Barringtonia*.

MELASTOMACEÆ :—Large genera : *Osbeckia*, *Melastoma*, *Sonerila*, *Dissochæta*, *Medinilla*, *Astronia*, *Kibessia*, *Memecylon*.

Endemic : *Oxyspora* (S.), *Driessenia* (B.), *Ochthocharis* (M.P. and S.), *Anerinoleistus* (M.P. & S.), *Phyllagathis* (Arch.), *Dalenia* (B.), *Creochiton* (J.), *Omphalopus* (J. & S.), *Pachycentria* (Arch.), *Pogonanthera* (Arch.), *Plethiandra* (B.).

LAURINEÆ :—*Cinnamomum*, *Actinodaphne*, *Litsea*.

Endemic : *Dehaasia* (Arch.), *Eusideroxylon* (B.), *Iteadaphne* (M.P.).

ACANTHACEÆ :—*Thunbergia*, *Eranthemum*, *Strobilanthes*, *Barleria*, *Asystasia*, *Justicia*.

Endemic : *Trichacanthus* (J.), *Filetia* (S.).

APOCYNACEÆ:—Large genera : *Willoughbeia*, *Alyxia*, *Alstonia*, *Tabernaemontana*.

Endemic : *Leuconotis* (Arch.), *Amblyocalyx* (B.), *Cerbera* (Arch.), *Dyera* (Arch.), *Micrechites* (Arch.), *Beaumontia* (Arch.).

ASCLEPIADEÆ:—Large genera : *Hoya*, *Dischidia*, *Ceropegia*, *Marsdenia*, *Stephanotis*, *Toxocarpus*.

Endemic : *Pycnorhachis* (M.P.), *Asterostemma* (J.), *Atherandra* (Arch.), *Myriopteron* (J.), *Conchophyllum* (Arch.), *Raphistemma* (Arch.), *Phyllanthera* (J.).

MALVACEÆ:—Large genera : *Sida*, *Abutilon*, *Hibiscus*, *Gossypium*.

Endemic : *Dialycarpa* (B.), *Durio* (Arch., 7 sp.), *Lahia* (B.), *Boschia* (Arch.), *Neesia* (Arch.), *Coelostegia* (M.P.).

STERCULIACEÆ:—Large genera : *Sterculia*, *Helicteres*, *Melochia*, *Buettneria*.

VERBENACEÆ:—Large genera : *Lantana*, *Lippia*, *Callicarpa*, *Vitex*, *Premna*, *Clerodendron*.

Endemic : *Geunsia* (Arch.), *Tectona* (Arch.), *Peronema* (Arch.).

ANONACEÆ:—Large genera : *Uvaria*, *Polyalthia*, *Melodorum*, *Xylopi*a, *Unona*, *Orophea*.

Endemic : *Tetrapetalum* (B.), *Sphærothalamus* (B.), *Marcuccia* (B.), *Enicosanthemum* (B.), *Ellipeia* (Arch.), *Drepananthus* (M.P.), *Monocarpia* (B.), *Disepalum* (B.), *Eburopetalum* (B.), *Anomianthus* (J.), *Marsyopetalum* (J.), *Mezzettia* (B.), *Kingstonia* (M.P.), *Lonchomera* (M.P.).

CONVOLVULACEÆ:—Large genera : *Erycibe*, *Argyreia*, *Lettsomia*, *Ipomœa* (very numerous), *Convolvulus*, *Evolvulus*, *Breweria*, *Cuscuta*.

MELIACEÆ:—Large genus : *Turraea*.

PIPERACEÆ:—Large genera : *Piper* (very numerous), *Peperomia*.

Endemic : *Zippelia* (J.).

SOLANACEÆ:—Large genera : *Solanum*, *Physalis*, *Capsicum*, *Lycium*.

SCROPHULARINEÆ:—Large genera : *Mimulus*, *Stemodia*, *Limnophila*, *Herpestis*, *Gratiola*, *Torenia*, *Vandellia*, *Striga*.

AMARANTACEÆ:—Large genera : *Celosia*, *Amarantus*, *Alternanthera*.

SAPINDACEÆ:—Large genera : *Allophyllus*, *Guioa*, *Arytera*.

Endemic : *Aphanococcus* (C.), *Schleichera* (Arch.), *Nephelium* (Arch.), *Pseudonephelium* (B.).

BEGONIACEÆ:—*Begonia*. A large number of species are found on the mountain summits of the Malay Peninsula, and generally throughout the Indian Archipelago.

TILIACEÆ:—Large genera : *Grewia*, *Corchorus*, *Elaeocarpus*, *Triumfetta*.

Endemic : *Pentace* (M.P. & J.), *Chartacalyx* (M.P.), *Schoutenea* (Arch.), *Phœnicospermum* (J.).

SAPOTACEÆ:—Large genera : *Chrysophyllum*, *Sideroxylon*, *Mimusops*, *Palaquium*, *Bassia*, *Payena*.

Endemic : *Diploknema* (B.).

OLEACEÆ:—Large genera : *Jasminum*, *Linociera*.

CUCURBITACEÆ:—Large genera : *Trichosanthes*, *Momordica*, *Cucumis*, *Melothria*.

ANACARDIACEÆ:—Large genera : *Buchanania*, *Mangifera*, *Swintonia*, *Rhus*, *Semecarpus*.

Endemic : *Pentaspadon* (Arch.), *Microstemon* (M.P.).

BORAGINEÆ :—Large genera : *Cordia*, *Ehretia*, *Rhabdia*, *Tournefortia*, *Heliotropium*, *Cynoglossum*.

AMPELIDACEÆ :—Large genera : *Ampelocissus*, *Vitis*, *Cissus*, *Leea*.

TERNSTREMIACEÆ :—Large genera : *Dupinia*, *Saurauja*, *Gordonia*.

ARALIACEÆ :—Large genera : *Aralia*, *Panax*, *Heptapleurum*, *Gilibertia*.

Endemic : *Hederopsis* (M.P.).

GUTTIFERÆ :—Large genera : *Garcinia*, *Calophyllum*.

CAPPARIDÆ :—Large genera : *Cleome*, *Mærua*, *Capparis*.

EBENACEÆ :—Large genera : *Maba*, *Diospyros*.

LYTHRARIÆ :—Large genera : *Rotala*, *Lagerstræmia*.

COMBRETACEÆ :—Large genus : *Terminalia*.

LOGANIACEÆ :—Large genera : *Mitrasacme*, *Geniostoma*, *Buddleia*, *Fagraea*.

Endemic : *Norrisia* (M.P.).

RHAMNEÆ :—*Zizyphus*.

MENISPERMACEÆ :—No large genera ; but the order is well represented.

GESNERACEÆ :—Large genera : *Æschynanthus*, *Didymocarpus*, *Chirita*, *Cyrtandra*.

Endemic : *Loxonia* (S. & J.), *Hexatheca* (B.).

POLYGONACEÆ :—Large genus : *Polygonum*. The Buck-wheat (*Fagopyrum*) is in cultivation.

DILLENIACEÆ :—Large genera : *Tetracera*, *Wormia*.

MAGNOLIACEÆ:—Large genus: *Michelia*.

BIXINEÆ:—Large genera: *Cochlospermum*, *Xylosma*.

Endemic: *Bennettia* (J.), *Pangium* (J.), *Bergsmia* (J.), *Tarakogenos* (J.).

NEPENTHACEÆ:—*Nepenthes*.

There are a few representatives also of the following orders:—

HYPERICINEÆ, SIMARUBACEÆ, RHIZOPHORACEÆ, ERICACEÆ, LENTIBULAREÆ, THYMELEACEÆ.

### MONOCOTYLEDONS.

Only a few Monocotyledons are here mentioned, either because they are specially dealt with under the headings of palms, orchids, &c., or because they would convey no idea of the flora. The grasses and sedges are wholly omitted, for there is little or nothing peculiar about them.

ZINGIBERACEÆ:—Large genera: *Globba*, *Hedychium*, *Curcuma*, *Amomum*, *Zingiber*, *Costus*, *Alpinia*, *Phrynium*.

Endemic: *Burbidgea* (B.), *Strobidia* (S.), *Riedelia* (Arch.).

AROIDEÆ:—Large genera: *Pothos*, *Rhaphidophora*, *Alocasia*.

Endemic: *Amydrium* (B. & S.), *Cuscuaria* (J.), *Podolasia* (B.), *Piptospatha* (B.), *Gamogyne* (B.), *Bucephalandra* (B.), *Aglaodorum* (S. & B.).

COMMELINACEÆ:—Large genera: *Commelina*, *Aneilema*, *Cyanotis*.

LILIACEÆ:—Large genera: *Smilax*, *Asparagus*, *Aloe*, *Dracena*, *Chlorophytum*.

PANDANEÆ:—Large genera: *Pandanus*, *Freycinetia*.

DIOSCOREACEÆ:—Large genus: *Dioscorea*.

AMARYLLIDEÆ:—Large genera: *Hypoxis*, *Crinum*.



For convenience the sub-divisions of the region will be taken in the following order :—

- (1) The marine littoral region.
- (2) The alluvial plains.
- (3) Lower mountain slopes.
- (4) Sub-alpine region.

Most of these regions are capable of further subdivision ; though the divisions seems simple, it is not always easy to separate them. There are regions of an intermediate character where it is hard to decide to what they strictly belong. Furthermore, though the whole country is clothed with forest, this is particularly true of the mountain regions. In the alluvial plains there are extensive areas of open plains with no timber except of a low bushy kind. The plains are clothed with coarse grasses and are composed of poor soil. Most of these plains are subject to inundation, and indicate the extent of the overflow by their limits. Lands liable to inundation are not always densely clothed with forest, for the contrary is the case in some instances. There are wide savannahs of coarse grasses without much timber in the Malay Peninsula, as well as open forests with little timber and a dense undergrowth of jungle. The latter term is made to mean many things. Any thick entangled tract of uncultivated trees and shrubs, is called jungle ; but what is distinguished by that term in Java, and what is known by the same name in the Straits Settlements, are two very different things, as will appear hereafter.

**MANGROVE FORESTS.**—What are called Mangroves are forests growing on shallow marine mud-flats inundated by every tide, and in fact living in sea-water more than out of it. Most of the species germinate from the fruit while it remains attached to the tree. The radical and club-shaped crowns of the root gradually lengthen until they reach the soft muddy soil where they strike root and form a close thicket down to the verge of the ocean ; a thicket both above and below. Above, the branches and leaves

entirely intercept the rays of the sun ; below, each tree is raised upon a stool of roots, which spreads around over considerable spaces. These roots are swollen, and succulent, arching from the stem to the mud with the convexity upwards, and gradually raising the main trunk high above the mud. Most of the trees belong to the order RHIZOPHORACEÆ, which numbers about 50 species distributed through 17 tropical genera. A few do not germinate on the tree, but drop the developed fruit, where immediately it takes root, and so helps to spread the forest. One of the genera (*Pellacalyx*) is peculiar to the Straits of Malacca, and two (*Placiantha* and *Combretocarpus*) are restricted to Borneo. The others in the Peninsula belong to the genera *Ceriops*, *Bruguiera*, *Carallia*, *Gynotroches* and *Anisophyllea*, the last with four styles, while all others except *Combretocarpus* have only one style. The commonest species probably belong to the genus *Bruguiera*.

Besides the RHIZOPHORACEÆ the Mangrove forests are made up of many other plants ; amongst which, in the Malay Peninsula, are three species, if not more, of *Sonneratia*, a genus formerly included amongst the MYRTACEÆ, but now placed with the LYTHRARIÆ. It lines the muddy estuaries of the Malay Peninsular, Borneo, and, as far as I know, all the islands of the Indian Archipelago. It goes by the name of the Willow, and forms fluviatile thickets some little distance into the interior beyond the Mangroves but where the water is still brackish. It is something like a willow, but distinguished by a depressed fruit, around which the sepals of the calyx stand out in rays, reminding one of popular representations of the sun. The fruits of *S. acida*, L.f., are eaten by the Malays. The wood is stigmatised as soft and useless by Kurz, but he and M'Clelland say that the strong, hard, close-grained wood of *S. apetala*, Buch., is useful.

Quite as abundant is *Egiceras majus*, Gaertn., which forms dense hedges round the islands of the Indian Archipelago and grows far outside the tropics in Australia. It is a pretty plant, covered for the most part of the year with cymes of fragrant flowers. It belongs to the MYRSINÆ or Ardisiads, an

order producing handsome shrubs with evergreen leaves and red berries, and which, strange to say, has its greatest development in New Zealand. *Egiceras* differs from Ardisiads in this, that the fruit, when ripe, becomes a follicle. Another shrub with the habits of RHIZOPHORACEÆ, though not belonging to the order, is *Avicennia officinalis*, L., a Verbeniad which extends all round the Australian continent, as well as being common in Asia, Africa, and America. The coasts of South Australia, especially in St. Vincent's and Spencer's Gulf, are thickly furnished with this kind of vegetable protection, which, though neither so luxuriant, so dense, nor forming such shady groves as the true tropical Mangrove, is thick and shrubby, and has a special beauty of its own.

Amid the Mangroves will be noticed a small tree with conspicuous fruits like a large green apple, three or four inches in diameter. This is (*Xylocarpus granatum*, Koen.) *Carapa moluccensis*, Lam. It has four to six large irregularly-shaped, closely packed seeds inside, which are said to be pressed for oil. It is not cultivated for the purpose, and it grows too scantily in the Mangroves to afford much oil. It extends to tropical Asia, westward to east Africa, eastward to the Moluccas, and southward to tropical Australia.

The Mangroves further inland are inundated only during spring tides. These thickets form a well-known belt within the true Mangroves, where the ground begins to be less muddy and a little higher and drier. Certain species are also found where there are no Mangroves at all, and these may be called the sea-coast tidal-thickets. The species found are *Hibiscus tiliaceus*, L., having large yellow flowers with a deep crimson centre, besides other showy species; *Thespesia populnea*, Corr., famous for the rich yellow dye exuding from the brown seed-vessel; *Heritiera littoralis*, Dryander, or the Looking-glass Tree; *Excoecaria agallocha*, L., a tree with a milky juice which causes blindness, and so does also even the smoke from the wood when it is burned; *Antidesma bunius*, Spreng., a euphorbiaceous tree which extends over the

Indian Archipelago, the Philippines and South China, having large acid fruits, black or white when ripe; *Cerbera odallam*, Gaertn., a glossy evergreen tree with white flowers and oval or elliptical green fruits (black when ripe), said to be extremely poisonous, but the seed of which is pressed for lamp oil; *Erythrina ovalifolia*, Roxb., with large dull purple flowers and the trunk armed with sharp thorns; *Dalbergia pongamia*, *Derris*, and other climbing leguminous plants, including *Abrus precatorius*, L., whose scarlet and black seeds are known all over the world.

The above are the common and conspicuous trees and shrubs amongst the Mangroves on the whole of the Malayan sea-coast. There are also found along the banks of the estuarine streams on the west coasts of the Peninsula, *Nipa fruticans*, Wurm., a Palm-tree which has not the advantage of a stem, but yet forms one of the most attractive and interesting members of the order. It lines the lower part of many of the coast streams to the exclusion of almost every other vegetation. It is difficult to describe the singular effect of long lines of feathery palm-leaves, twenty to thirty feet long, gathered in thick clusters on both sides of a river. The plant is one of the giants of vegetation, and it is as useful as it is big. The leaves are cut down and form all the houses in the Malay region. The pinnæ of the fronds are plaited in various forms to make walls, wainscots, and partitions. Throughout Malaysia the people have no other roof for their dwellings than these fronds laid over each other like tiles, giving a leafy covering more or less impervious to rain. It is good enough unless when the wind lifts it up, and then woe to the interior of the dwelling in a tropical storm. This is the well-known attap roof universal in the Peninsula.

Further up the banks the thicket is intermingled with a fern which is a giant of its kind (*Acrostichum aureum*, L.) with fronds eight and ten feet long, and a showy prickly Acanthaceous plant with blue and white flowers (*Acanthus ilicifolius*, L.), both of which are as common in Northern Queensland as they are in the Malay Peninsula. A Screw-pine (*Pandanus*) almost com-

pletes the census of this river-bank flora, for the *Nipa* absorbs everything. Such thickets does it make that whole islands are floated off by the spring tides, and these cruise about, especially off the coast of Borneo, like patches of marine jungle. I can testify to the strange appearance they present when met far from the land, sheltering sea and land birds together. The fruits on a short stalk amongst the stolons are quite as big as a man's head. They are cut off before maturity, and the juice which exudes is fermented, and forms an acid and not very agreeable stimulant.

Altogether the Mangroves are of the highest interest to botanists, and possess a beauty of their own. It is a wonderful provision of nature which associates together so many luxuriant trees of great beauty of foliage, growing so richly in salt water, a medium fatal to nearly every land plant.

ALLUVIAL PLAINS.—The alluvial plains are thickly studded with clumps or belts of timber, and open grassy savannahs where the lofty Lalang or jungle-grass (*Imperata arundinacea*, Cyr.) meets above the head. This is interlaced by many climbers such as the climbing ferns *Lygodium scandens*, Sw., *L. japonica*, Sw., and *L. flexuosum*, Sw. At a distance such open spaces look like meadow-land of bright green with little clumps of trees like a park. But the ground underneath is sloppy, and the meadow is full of coarse vegetation and harsh grasses very difficult to walk through. It is a flowery region. About Singapore and through all the Straits Settlements *Thunbergia alata* with its yellow or white blossoms, and a very large-flowered blue species, *T. grandiflora*, are common in almost all the clumps of trees. *Callicarpa longifolia*, a tree with minute pink flowers in large clusters, is everywhere on the plains, with a tender spring-like look about it. Showy *Ixoras* also are common with a profusion of long-tubed scarlet, pink or white flowers. But most frequently met is *Melastoma malabathrica* with large pink salver-shaped flowers. It is like a dog-rose at a distance except for the few long stamens with a prolongation of the connective ending in two spurs. This species is as common at Hong Kong as in the Straits Settlements, and equally so



in Australia as far south at least as Moreton Bay. The structure is well worthy of attention. The stamens, ten in number, are dissimilar in size, shape and colour, five being large, violet, and having two long spurs, and five small and yellow with no projection. It may possibly be mistaken for *Rhodomyrtus tomentosa*, a shrub four or five feet high with large pink flowers, but they are axillary. The species is widely spread over Southern India, Penang, Malaysia and northwards to China and Japan, and the Philippines. The natural order of MELASTOMACEÆ is largely represented in the flora of Malaysia.

Besides the grassy plains in places the forest is rendered almost continuous by a better or drier soil. Around Singapore the flora is modified thus. The place of the grass is taken by large bushes of *Gleichenia dichotoma* and *G. flagellaris* which, with a few other ferns (*Blechnum orientale*, a species of *Lomaria*, *Polypodium*, *Vittaria*, &c., &c.), entirely occupy the ground. There is an undergrowth, however, in places of the *Melastoma* and *Rhodomyrtus*, *Cassia alata*, *C. sepiaria*, *C. tora*, *Solanum verbascifolium*, *S. ferox*, *S. sanctum*, and *Lantana camera*. There are few palms, but I have noticed occasionally that extremely handsome palm-tree *Cyrtostachys rendah*, though much more common in Labuan than it is at Singapore.

The alluvial plains are varied by occasional swamps which are always thickly covered with *Nelumbium speciosum*, L. This solitary species demands a passing notice. It lives with its rhizomes buried in the mud. Its large orbicular leaves on the upper surface, which, determined to breathe air, break up the water into crystal dew-drops; the large, deep rose-coloured flowers and the nuts or seeds nearly buried in a receptacle like the rose of a watering-pot, all make it a most interesting, as well as beautiful, ornament to still waters. The *Nelumbium* is indigenous in the waters of the Nile, and is found in the rivers of Persia and India; in Cashmere up to a height of 5,000 feet; in the Volga up to the 46th degree of north latitude; in China; in Japan; and then in tropical Australia. Probably some of this wide-spread area is



due to introduction. It divides the beauties of the still waters in Malaysia with *Nymphæa*, a large blue, yellow or red-flowered water-lily even bigger than *Nelumbium*, easily distinguished by the cluster of stamens in the middle. Its leaves float in the water, and they are recognised by their very long stalks, which are much sought after in North Australia by the natives as an article of food. So is the root of the plant also, and even the Malays make use of it. All that might be said about this flower may be guessed in saying that it is the Lotus of the ancients.

Sometimes the open forest is dry and rocky with out-crops of Laterite. This supports a somewhat different flora such as *Malotus philippinensis* and *M. javanica*, *Cinnamomum spurium*, *Fagraea peregrina*, several species of *Eugenia*, *Ficus*, *Mæsa* (a large genus of MYRSINÆ belonging to Africa, Asia, and Australia), *Phyllanthus emblica*, a feathery-leaved small tree with conspicuous green acid fruits, *Sindora siamensis* (?), a tree with one-seeded indehiscent spiny pods borne on long pedicels. There are several species of *Myristica* or wild Nutmeg, notably a long-leaved form with a thick brown tomentum (*M. sesquipedalia*). *Adinandra dumosa* is a common and handsome tree of the tea family.

RIVER VEGETATION.—This is the richest portion of the forest lands and supports a dense growth of trees. It would require a long list to describe this flora. On the banks of even the small creeks I have seen the finest trees, and the undergrowth is so dense that daylight scarcely penetrates. The common trees are *Ficus* (many), DIPTEROCARPEÆ including *Shorea*, *Hopea*, *Vatica*, *Artocarpus* (many), *Castania*, *Castanopsis*, and plentifully, *Rhodamnia trinervia*, *Cratoxylon polyanthum* (one of the St. John's Worts), *Evodia roxburghiana*, *Ixonanthes icosandra*, *Phyllanthus superbus*, *Elæocarpus* (several), *Canarium* (two or three), *Commersonia echinata*, *Vitex trifoliata*, *Macaranga tanarius*, *Pithecolobium* (several), *Maba ebenus*, *Diospyros fruticosus*, *Alstonia macrophylla*, *A. scholaris*. The last named is seen quite as frequently on the grassy plains where it lifts its head as a conspicuous straight stem,

divided into regular stages by whorls of large laurel-like leaves. Occasionally one meets *Antiaris* or the far-famed Upas-tree, formerly supposed to be confined to Java. The natives know it well, but do not seem to be much afraid of it, at least in the manner related by travellers of old. There is also a large fleshy fetid Aroid named *Amorphophallus* likewise used as a poison for arrows, or to intensify the venom of the Upas, here called Ipo.

This vegetation is laced together by numberless vines and creepers, such as *Entada scandens* with enormous pods, and beans large enough to be made into match-boxes; *Mucuna gigantea* with its crop of irritating hairs on the outside of the pod. *Bauhinias* abound as well as Melastomaceous creepers of the genera *Medinilla* and *Sonerila*. The true vines (*Vitis*) are represented by many species, as well as climbing genera of the natural orders MENISPERMACEÆ, APOCYNACEÆ, ASCLEPIADEÆ.

The Palms, as might naturally be expected, are numerous, including the destructive *Calamus* whose thorns few escape in the jungle. They are perennial spreading shrubs or small trees, lithe and supple, erect as well as climbing. The whole plant is densely clothed with formidable thorns. It is difficult to keep out of their way. The petiole is modified into a thong or prolongation, covered with hooked prehensile spines of cruel design. Woe to those who are caught in these tendrils. The struggle to free oneself from one brings down a dozen, each being as difficult to detach as a puzzle. *C. grandis* is common at Penang and in all the Straits of Malacca, with many species besides. *C. rotang*, *C. rudentum*, and several others are largely exported for chairs, baskets, mats, hats and other useful articles. The celebrated Malacca canes are derived from *C. scipionum*. It is not common, and the natives who gather, stain and sell it, do not care to make its habitat known. It does not grow anywhere near Malacca. *Zalacca edulis* is a tufted short-stemmed palm with leaves eighteen to twenty feet in length, growing abundantly in moist shady places. The pinnules about eighteen inches long and five broad, are at first ascending, then curved downwards, oblong-spathulate, lanceolate

and tapered into a long subulate bristle. They are 3-keeled above, the margins furnished at intervals with short bristles. Other Palms might be named, but they belong more to the mountains than to the alluvial plains.

Finally a few of the common trees may be mentioned. They are *Randia densifolia*, *Memecylon plebeium*, *Gironniera celtidifolia*, *Symplocos pedicellata*, *Rourea splendens*, and several species of *Elæocarpus* which the natives here call Jelei.

The undergrowth includes one or two remarkable plants. One is *Haloragis disticha*, a showy little shrub something like Box only that its leaves are pointed, while the branches spread out in distichous sprays of a neat and graceful form. No one would take it to be a *Haloragis*, though this is one of the non-aquatic genera in an order principally composed of water-plants. It is met occasionally on the mountain sides. *Leea sambucina*, a member of the vine family without tendrils, and a shrub, is conspicuous for the deep crimson colour of its younger leaves, whose stalks are dilated at the base so as to enclose the plant in a kind of sheath. It extends to the tropics of Australia, and perhaps is identical with a common African form. *Trema virgata* and *T. amboinense* are frequently seen, mingled occasionally with more than one species of *Uvaria*, having clusters of fruits like a bunch of yellow grapes on which the monkeys are said to feed. *Uvarie* are climbing plants, beautiful looking with their golden fruits, and showing under the microscope most interesting stellate hairs. The LEGUMINOSÆ have many representatives, such as species of *Indigofera*, *Tephrosia candida*, *Crotalaria striata*, several species of *Cassia*, *Derris*, and *Albizzia*. The ornamental shrubs include *Ixora*, *Gardenia campanulata*, *Clerodendron velutinum* and other species, *Pavetta indica*, differing but little from the *Ixoras* except in having the corolla twisted in the bud, *Draccena angustifolia*, *Dianella ensifolia*, several species of *Costus*, with the large and luxuriant *Alpinia nutans*. Amongst the useful plants may be mentioned one highly valued through the east as far as Japan. This is *Delima sarmentosa* (*Tetracera*), widely distributed in tropical Asia.

The upper surface of the leaves is covered with hard asperities, so rough that the leaves are used (like many kinds of Fig-trees) as a substitute for sand-paper.

The character of the river vegetation will be best understood from the following entry in my diary :— “ Got the elephants loaded in good time and sent them away. Walked two miles on a good road to a village on the banks of the Kinta. Crossed the river on elephants, and then succeeded a tedious journey through swamps, the elephants being mostly up to their bellies in mud. After this we went through an open jungle supporting a thick weedy growth of *Lantana camera*, with a small *Eugenia* and *Melastoma malabathrica*, the fruits of both of which our Malays ate freely, though the berries were small and unpalatable. The country soon became thick forest, both boggy and broken under foot, on a track which none but an elephant could travel. Emerging from this we came upon a deserted plantation of which there are, alas, a good many in Malay countries. It was on a rising ground, covered with *Lantana* but intermingled with *Solanum pentadactylum*, rendered conspicuous by yellow fruits with protuberances something like fingers. This is a native of Trinidad about Saint Anne’s and the port of Spain. It is a shrub two or three feet high, with an erect stem, and leaves sinuated, with acute segments shining above. It looks as if it had been cultivated, but the Malays do not eat the fruits and said they were poisonous. This is one of many instances in Malaysia, of small patches of an introduced plant flourishing as a weed, but very local; more common amongst the SOLANACEÆ than any other order.

“The view from this abandoned farm was across a wide plain to the eastward, bounded by an abrupt and broken range. The forest was open, and looked like moorland in Europe. When we got off the cultivated area we plunged into a dense growth of *Costus*, a shrub of ornamental character belonging to the ZINGIBERACEÆ. Thickets of this kind are common, 12 or 14 feet high. The only method of making one’s way through them is by the aid of the jungle-knife or parong, which has to be slashed right and left with

much force. A journey of a quarter of a mile thoroughly exhausted our Malays, and we were not sorry to find ourselves once more upon the swampy ground of the river Raya and close to the village of that name."

LOWER MOUNTAIN SLOPES.—There is a decided difference between the forests on the lower slopes of the mountains and those on the summits and on the plains. The trees are more varied and finer. In fact, this is where the forests are seen in their grandeur, because on ridges or the summits of ranges the trees are often stunted and the timber poor. In the lower forests the undergrowth, amid dead and decaying timber, is nearly impenetrable. The surface of the ground becomes only occasionally visible, and the difficulty of travelling through such places is really great. In this region and that of the plains are the same genera, slightly varied in proportion, but with a more stately and luxuriant growth. *Dipterocarpus*, *Shorea*, *Hopea* and *Vatica* are numerous, with Fig-trees, Chestnuts, Oak-trees, and an occasional coniferous tree of the genus *Dammara*. It was always a subject of admiration to me to notice the varied tints of the vegetation on the mountain slopes. At a distance they wore a uniform hue of sombre green or purple; but when near it was surprising how the surface was dappled with colours like a garden bed. Trees that looked like bunches of pink, bluish-red or yellowish flowers, stood out in surprising numbers. This appearance was often due to blossoms; but also it was owing to the variegated leaves, and, sometimes though more rarely, to the fruits. Those common and conspicuous were *Cinnamomum spurium*, a *Castania* or *Castanopsis* (a genus which cannot be maintained), a sapindaceous tree named *Cupania fuscidula*; and trees of light green foliage, such as *Eriodendron* and *Albizia*, help to vary the colour. There are also several species of *Artocarpus* and *Eugenia*, with wild *Garcinia* or Mangosteens, Ebonies, the real *Ebenus*, and *Diospyros fruticosus*, *Canarium*, *Guttas*, *Isonandra*, *Bassia* and *Dichopsis*, with the useful *Fagraea peregrina* and another *Fagraea* with large flowers, of which more presently. The Palm-trees belonging to this region



are *Arenga*, *Areca*, *Calamus*, *Eugeissona*, *Caryota*, *Corypha* *Licuala*, the Nibong which is an *Areca*, with *Slackia* and *Macrocladus* which the Malays call Ebul.

SUB-ALPINE REGION.—In the higher mountain regions the tree vegetation becomes smaller and more scanty, and on the summits almost disappears. There is an alpine vegetation, differing altogether however from what is understood by that name in European countries. This flora is of an Australian character, a fact difficult to explain. It includes *Melaleuca*, *Leucopogon*, *Vatica*, *Rhododendron*, and *Nepenthes*, mingled with peculiar cryptogams and the conifer *Podocarpus*. A similar flora is seen on the mountains of Borneo, Java, Celebes, and some of the Philippine Islands.

Over about 3000 feet above sea-level the vegetation becomes thinner and smaller. Cryptogams take the place of dicotyledonous plants, and even these, where they are not peculiar, are less tropical. A species of *Pterocarpus*, several members of the Tea family (TERNSTREMIACEÆ), some PITTOSPOREÆ (*Bursaria* ?), a *Microtropis* and *Euonymus* (CELASTRINEÆ), an *Ilex*, and a *Daphniphyllum* are amongst the remarkable plants, with Orchids, Begonias, Caladiums, Marantas, Lycopods, Selaginellas, Ferns, Mosses, Lichens, and Fungi innumerable.

LIMESTONE ROCKS.—The numerous outliers of limestone have a distinct flora, but not the same in every place. Certain species re-appear wherever the limestone crops out. Owing to the facility with which limestone strata are eroded, they are generally detached, precipitous and inaccessible mountains. A striking instance is Pondok in Perak, which is a gigantic rock at the eastern opening of the pass at Gapis, about 1500 feet above the level of the sea.\* It is crystalline, and the stratification seems to be almost obliterated; but yet what does remain in this and other places has a considerable dip. I have never heard that

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\* In my report on the geology of Perak this, by a misprint, is stated to be only 300 feet high.



anyone was able to get to the summit ; but it is full of fissures and cavities which are overgrown with a luxuriant and apparently peculiar vegetation, differing from that of the country around. At Selangore, at the limestone caves, I was able to make a good collection of plants, but they were mostly Lycopods and Ferns. Similar limestone cliffs are found in the Calamianes and Cuyos Groups, amongst both of which I collected plants, but not many, as the difficulty of getting on to the rocks was nearly as great here as at Gunong Pondok. Ferns and Lycopods were, as usual, the principal spoils, with, in the Philippines at least, a *Tristania*.

DIPTEROCARPEÆ.—This is a natural order of fine forest trees with conspicuous fragrant flowers, yielding good timber and valuable aromatic resins, balsams, and oils. It is an order which stands aloof, so that its limits can be concisely defined. Its peculiarities are the long wing-like lobes of the calyx, with nerves like the root-scales of a fern, and generally richly coloured from red to brown. The leaves have rolled-up stipules like the Magnolias, and they terminate the branches with a taper point ; the foliage is like that of an oak tree, and as in oaks the cotyledons perform their office without rising above the ground. The cup of the acorn and similar organs in the filbert, chestnut, beech, &c., are represented in the hardened calyx of these trees, which have a tendency to sacrifice all the ovules but one. The order flourishes best in the Malayan region, and is confined to tropical eastern Asia. The species range on the west from Assam, through eastern Bengal to Ceylon. Eastward they extend through Burmah and Siam to Cambodia and the Philippines. Southward they are found in the Andaman Islands, the Malayan Peninsula, Borneo, Sumatra, and Banka ; but only to a small extent is the family at present known east of Wallace's line through the Straits of Macassar.

The order was discovered in 1798 ; four species of *Dipterocarpus* were sent to Sir Joseph Banks by Dr. B. Hamilton from Sumatra. But the order was not defined until 1825 by Gaertner. At that time a dozen species were not known, and now there are upwards

of 200. It is divided into about a dozen genera, namely—(1) *Dryobalanops*, (2) *Dipterocarpus*, (3) *Ancistrocladus*, (4) *Anisoptera*, (5) *Pachynocarpus*, (6) *Vatica*, (7) *Shorea*, (8) *Hopea*, (9) *Doona*, (10) *Vateria*, (11) *Monoporandra*. Some botanists include the genus *Lophira*, which Endlicher erects into a separate order from its marked differences. It does not, however, belong to the Malayan region, but to west Africa.

*Dipterocarpus*—trees with two winged seeds—has given the name to the order. In reality there are five wings, but two of the lobes are much larger than the other three, which crown the calyx as small leaf-like sepals. *Dryobalanops* has the lobes of the calyx nearly equal, and they form five spreading wings round the fruit, something like a shuttle-cock. In *Ancistrocladus* the five lobes of the calyx are similar, but the genus is composed of climbing shrubs with claw-like thorns. In *Anisoptera* there are two large wings with inconspicuous stipules; its ovary and fruit partly inferior in reference to the insertion of the calyx, but having a concave receptacle, the edges of which bear the corolla and stamens. In *Vatica* there are five stamens opposite the petals, five alternate with them, then outside each of these a small stamen. *Vatica* is distinguished by its calyx, which is sub-valvate or with pieces not touching one another in the bud, and forming round the fruit five large free wings not adherent to the fruit but enveloping it closely. *Pachynocarpus* has the same flowers, a concave receptacle with a calyx which disappears round the fruit. *Vateria* has the free ovary of *Vatica*, but a small calyx reflexed under the pericarp. *Monoporandra* has the fruit of *Vateria*, but only five stamens. *Hopea* has the flower of *Vateria*, and two only of the five non-adherent sepals dilated in wings round the fruit. *Shorea* can hardly be separated from *Hopea*; but if distinguished at all, it is by the *three* large wings developed from the calyx lobes. *Doona* has three wings also, enclosing an embryo with cotyledons full of much-contorted folds, and the flowers are red.

All the species of this order are filled with resins, balsams, or oils, which render them valuable. The Oil-tree of the Malays is

derived from *Dipterocarpus levis* or *D. turbinatus*, for the two species are now united. It extends from eastern Bengal to Singapore and perhaps further. The oil is abundant and is obtained by cutting a kind of well in the stem, which opening is charred around by lighting a fire inside it, and then left for the oil slowly to exude. The exudation separates into two portions, one liquid and bland, and the other thick. The quantity produced is extraordinary. The oil is extracted every year; and sometimes the same tree will have two or three cavities in it. From 20 to 40 gallons is about the quantity produced each season; but from time to time the fire has to be renewed in the cavity to char the surface afresh. When a tree in full growth is cut down and divided into pieces, a quantity of oleaginous resin exudes and hardens on the surface into something like camphor, and with a faint aromatic odor.\*

The Malays call this tree Palagtar mienjak, but both in Sundanese and Javanese Palaglar is a name applied to all the species

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\* As the above species (*D. turbinatus*, Gaertn.) has such interest and value a botanical diagnosis is here inserted. "The species bears terminal clusters of from three to five flowers. The flowers are hermaphrodite with a slightly concave receptacle. The calyx is formed of five sepals united into a tube at the base and very unequally developed; three of them remaining very small, while the two others grow into large oval wings above the fruit. The tube of the calyx is obconical. It is developed at the same time as the fruit and closely envelops it. The corolla is formed of five alternate petals, nearly of the same length, slightly perigynous, twisted in the bud and colored a rose pink. The stamens are indefinite, inserted on several circles. Anthers elongate, acuminate, formed of two linear cells, introrse, opening in longitudinal slits; ovary very slightly inferior to the base, trilocular, surmounted by a filiform style, entire or slightly tridentate, each ovicell with two anatropal ovules collateral with the micropyle directed upwards and outwards, inserted in the internal angle of the cell. The fruit is a pubescent spherical nut, surrounded by the tube of the calyx, with two sepals divided in large linear-lanceolate obtuse wings, with three longitudinal veins giving off laterally numerous slightly oblique anastomosing venules; pericarp dry, woody, indehiscent; seeds free, without albumen, enclosing an embryo between thick fleshy unequal cotyledons and a slightly developed superior radicle. Leaves alternate, coriaceous, smooth on both sides or a little pubescent on the veins and edges, oval or wide, lanceolate, entire or sinuate, pointed, rounded at the base, penninerved with parallel veins, petiole long, with two lateral much-developed stipules surrounding a leaf-bud and falling when it opens, leaving an annular scar." J. D. Hooker, "Flor. Brit. Ind.," pt. 2, p. 295.

of *Dipterocarpus*, and other balsamiferous trees such as several species of *Mastixia* and *Girronniera*.\* The balsam of *Dipterocarpus* is called Gurjun in India, and is enumerated amongst the products of India, Burmah, and the Malayan region, by various authors since the commencement of this century. Its medicinal properties were pointed out by O'Shaughnessy ("Bengal Dispensary," 1842, p. 222) as being equal to Copaiba, and as such it has now obtained a place in the Indian Pharmacopœa. Balsam of Gurjun varies somewhat in its character because it is derived from different trees of the order, all of which are more or less balsamiferous. The basis or the acid crystallised from the resin is called Gurgunic Acid by Werner, who gives it the chemical formula  $C_{44}H_{64}O_5 + 3H_2O$  which is that of hydrate Abietinic Acid † and probably identical with that and Metacopaibic Acid.

This statement of the qualities of *Dipterocarpus turbinatus* will serve as a specimen of the whole. The balsam of *D. trinervis* is used in Java for wounds. It furnishes a dye, and with the yolk of an egg an emulsion of the same efficacy as copaiba. I have seen torches made of banana leaves smeared with this dammar as mentioned by Blume. The light is brilliant and the smell agreeable. The Camphor Tree of Borneo and Sumatra, and which I think I have seen growing in the state of Selangore also, is *Dryobalanops aromatica*, Gaertn. The product is best and most abundant where it is found in the wood. De Vriese tells us (Hook. Lond. Jour. IV. p. 33) that its price is high in Sumatra where it is called Kassa baras, and the rajahs do not care to export it, but use it to embalm the remains of royal personages. The same kind of camphor is known in China and Japan, where it is sold as a drug for a tonic and stimulant. The same tree also exudes a small quantity of aromatic or balsamic oil, called Oil of

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\* *Mastixia* belonging to the order CORNACEÆ, has about six species in Java, &c., and two in Ceylon. *Girronniera* belongs to the order URTICACEÆ, with seven or eight species extending from Ceylon through the Malayan region to South China and the Pacific Islands.

† Derived from Canada balsam, an exudation from the Canadian cedar.

Camphor, obtained by incisions and collected in half-cylinders of split bamboo. After straining it is put into bottles for preservation. "*Vateria indica* is the tree from which is obtained a false resin, called Copal in India, which when fresh appears under the form of a liquid varnish called Pimen dammar or Piney varnish in British India; it is solid, tenacious, but has the inconvenience of melting at a moderately low temperature. (36.5°C.). According to Wight it is obtained by making incisions in the trunk where the liquid collects and hardens. In Malabar wax lights are made of it which give a brilliant light and exhale a perfumed odour." (Baillon, "Nat. Hist. Plants," IV. p. 219).

Formerly it was stated in most treatises on the geographical distribution of plants, that the flora of New Guinea is thoroughly similar to that of Borneo, and that its vegetation is an eastern extension of the Indo-Malayan flora. Sir Joseph Hooker, on the other hand, in denying this statement, pointed out that none of the DIPTEROCARPEÆ had been found to the east of Borneo. This, however, was equally incorrect, as I have seen the order as well represented in the Philippines, the Sulu Archipelago, and in all the islands of the Molucca Passage where I landed, including the Xulla Islands and some others down to Amboyna, as in Borneo or the Malayan Peninsula. The explorations of Beccari have also shown that a few species occur in New Guinea, but the small number of species found there (three I believe) shows a remarkable falling off from the preponderating influence of the order in the Malayan region.

Mr. Thistleton Dyer has chronicled a single endemic species in the Seychelles group, which is, to use his own expression, "like that of *Nepenthes pervillei*, an interesting connecting link between the Indo-Malayan flora and its westward outlying extensions in Madagascar and central Africa." (See "Journal of Botany" for 1878, page 98).

The order is well represented in Cochin-China, Tonquin, Cambodia, and Siam. I frequently remarked in Cochin-China large trees with the trunk blackened about a yard from the soil, with



the well-known oil-cavity. This tree, I was informed, is called "Dau," and by the French "l'arbre à huile." It is stated that the bast is the part from which the oil only flows, at least that is the Anamese idea, which is incorrect, for the cavity is always made in the heart-wood.

The order is well known in Burmah to the north of the Malay Peninsula. Here *Dipterocarpus* is one of the commonest and best known trees, and gives its name to the forests of the plains. It is called "Eng," and the Eng forests are truly the characteristic features of the Burmese region. Kurz in his "Forest Flora of British Burmah" often refers to them, classifying two parts of his botanical regions as the "Hill and Plain forests." It will help our comprehension of the Malayan flora to quote his words:—

"ENG OR LATERITE FORESTS.—The principal constituents of this forest are Byoo (*Dillenia pulcherrima*), Phthya (*Shorea obtusa*), Engyeen (*Pentacme siamensis*), Joeben (*Walsura villosa*), Moon-deing (*Lophopetalum wallichii*), Myoukzee (*Zizyphus jujuba*), Lam-bo (*Buchanania latifolia*), Thit-say (*Melanorrhœa usitata*), Dan-yat (*Symplocos racemosa*), Tay (*Diospyros burmanica*), Tasha (*Embllica officinalis*), Ziphyoo (*E. macrocarpa*), Engyen (*Aporosa macrophylla*), Yemine (*A. villosa*), Yindyke (*Dalbergia cultrata*), *Wendlandia tinctoria*, Toukkyan (*Terminalia macrocarpa*), Banbwe (*Careya arborea*), Kone-pyenma (*Lagerstrœmia macrocarpa*), Khaboung (*Strychnos nux vomica*), Nabbhay (*Odina wodier*), Yingat (*Gardenia obtusifolia*), Thameng-sa-nee (*G. turgida*), Tha-byay-hpyoo (*Eugenia jambolana*), *Sideroxylon parvifolium*, Na-yu-wai (*Flacourtia sapida*), and others. The Eng (*Dipterocarpus tuberculatus*) is the characteristic tree of this forest. Moondein (*Cycas siamensis*) is plentiful in the Prome forests. Palms are represented only by a stemless Date-palm (*Phoenix acaulis*) called Thin-boung, and here and there by an erect much-reduced rattan called Kyeing-kha (*Calamus gracilis*). Of bamboo are seen only Myin-wa (*Dendrocalamus strictus*), and less so Tei-wa (*Bambusa tulda*) along the outskirts of the forest. Climbing vegetation has almost disappeared. Ferns are rare,

but Orchids and some Asclepiads are plentiful. The shrubs here are meagre and sparse, but still exhibit a great variety of species, and the same may be said of the clothing of the ground. The display of gaudy flowers during the hot season on trees as well as on the ground is often very striking. Where depressions occur, they are usually filled up with stiff clay inundated during the rains, and such places are more or less densely covered by thin dry grass and sedges."

"HILL ENG FORESTS.—These forests occupy the ridges of the outer hill ranges of Martaban and Upper Tenasserim, where they luxuriate either on Laterite formed by decomposition of the underlying rock or on débris of metamorphic rocks. In general aspect they agree with the Eng forests of the plains; but numerous trees occur in them, which are peculiar to them, or very rare in those of the plains. The Eng tree (*Dipterocarpus tuberculatus*) is still represented here, but is also often replaced by, or intermixed with, two other wood-oil trees, viz.,—*D. costatus* and *D. obtusifolius*. Other conspicuous trees are *Engelhardtia villosa*, *Quercus brandisiana* and *Q. bancana*, Pauma (*Schima bancana*), Thit-say (*Melanorrhœa glabra*), *Castanea tribuloides*, *Tristania burmanica*, *Anneslea fragans*, etc. Various trees of the true Eng forests and sometimes of the drier hill forests associate, like DOUNG-HSAP-PYA (*Callicarpa arborea*), *Dillenia aurea*, *Rhus javanica*, *Vernonia acuminata*, etc." ("Introduction," Vol. I. p. xxii).

The above descriptions of the Burmese *Dipterocarpus* forests will serve to show the unity of the vegetation; and indeed with the exception of the appearance of some new species, and the disappearance of others with no great difference between them, there is only one aspect for the flora between Borneo and Ceylon.

DAMMARA TREES AND CONIFERS.—Some of the varnish derived from the *Dipterocarpus* trees goes by the name of Dammar, which is a Malay term. There are several kinds of dammar, but the one termed Dammar puti or batu (white or stone dammar)

is derived from a coniferous tree, which takes a leading part in the formation of forests on the mountain. In ascending to the summits of any of the high hills, one is sure to notice, round the stems of certain stately-looking trees, deposits of yellowish white resin. This comes from a tree which is a near relation to the Pines and *Araucarias*, but differing in appearance from any of them except in this that wherever the bark is wounded quantities of the resin exude. "The Dammaras are distinguished from the true Pines and Firs by their broad, opposite or alternate, oblong-lanceolate, attenuated leathery leaves, with parallel veins, and in the male and female flowers being solitary and on separate plants: they however approach nearest to the genus *Araucaria* in being dioecious, but from which they differ in the form of the scales, in the absence of a bractea to each female flower, and in the seeds being winged only on one side, and free or unattached." ("Pinetum, A Synopsis of all the coniferous Plants." By Geo. Gordon, 3rd ed. p. 108). There is only one species, which is a tree growing upwards of 100 feet high, with a straight, smooth bark and trunk, from eight to ten feet in diameter, found on the summit of the mountains of Amboyna and Ternate, and in many of the Molucca Islands, Java, and Borneo. Timber of little value, but producing a fine transparent resin, and esteemed by the natives for incense. There is a variety having longer and more lanceolate leaves with the edges rolled on the under side, slightly undulated, whitish, and tapering to the point, and with the bark on the branches of a whiter colour.

Europeans distinguish the resin of *Vateria indica* as Piney dammar, that derived from *Shorea* and *Hopea* as Dammar simply, like the conifer, while the resin of *Dipterocarpus* is distinguished by the Indian name Gurjun, and that of *Dryobalanops* as Camphor. No distinction is made in the uses to which these resins are put except the camphor. They are largely employed for caulking boats, and with the oil are combined for making various varnishes.

MELASTOMACEÆ.—Another of the remarkable and common members of the flora of the Malayan Peninsula is this order. They are plants of warm climates, few extending into the sub-tropical regions. Generally they may be distinguished by their remarkable opposite leaves, which have five to seven deeply impressed curved longitudinal veins, and with long beaks to the anthers. The prominence of the lateral ribs in the leaves gives these plants some resemblance to species of MYRTACEÆ; but with a few exceptions, the leaves of the *Melastomas* are without transparent oil-glands.

Out of 134 genera in the order, 29 are found in the Malay region; the rest belong principally to South America, excepting a few in Africa and Polynesia. The order is divided into three sub-orders, namely, MELASTOMEÆ, ASTRONIEÆ, and MEMECYLEÆ. The first has no less than twelve tribes, the first of which (Microlicieæ) is almost confined to America; the second (Osbeckieæ) has 29 genera of which three only, *Osbeckia*, *Otanthera* and *Melastoma*, are represented in the Malay Peninsula, but these rather extensively. The Rhexieæ and Merianieæ with ten genera are American; the Oxysporeæ with ten genera is scattered over a large area between Madagascar and Japan; the tribe Sonerileæ with 13 genera has representatives in Asia, Africa and America, and throughout a large area. The tribe Medinilleæ with eleven genera has nine of them represented in the Malay Peninsula and one of them (*Medinilla*) with many species. The Miconieæ with 30 genera belongs almost exclusively to tropical America, and so does the next tribe, Blakeæ. The other two sub-orders have only six genera. The ASTRONIEÆ with four genera is almost exclusively Malayan with the exception of a few species in the Pacific region. The last sub-order, MEMECYLEÆ, has only two genera, both of a decidedly aberrant type. One, *Mouriria*, has thirty species, all American; the other, *Memecylon*, with a hundred species, in Asia, Australia, the Pacific Islands, Ceylon and Africa, but all within the tropics.

The order is closely connected with that of the Myrtles, which, as most readers are aware, consists of trees and shrubs usually

with opposite entire leaves marked with translucent dots. The stamens are indefinite. Not only, however, is there the closest relationship between the two orders, but they pass into one another, so to speak, in the genera *Blakea*, *Astronia*, and *Mouriria*. *Mouriria* has no ribs on the leaves, which are very distinctly dotted. *Diplogenea* shows also some signs of dots, while *Memyylon* has no lateral ribs, neither has the large genus *Sonerila*.

There is a strong resemblance also between the two orders in the variations to which the typical structures are subject. To mention no more than the leaves, we find almost every variety of form amongst the Myrtles, such as in the genus *Calythrix* where they are scattered (not opposite), small, semi-terete, three- or four-angled, rigid, and as unlike the leaves of a myrtle as possible, to the showy coriaceous forms amongst the *Eugenia*, *Tristania*, &c. In the MELASTOMACEÆ there is just as much variety, which seems to follow the same lines. The characteristic leaf-structure in some of the South American species disappears. For instance, in the genus *Fritzschia* the leaves are small, coriaceous, sometimes dentate, and with impressed dots; in *Lavoisiera* they are small and decussately imbricated; in *Marcetia* small and heath-like, and so forth.

It would seem as if the MELASTOMACEÆ are, in the Malaysian region, what the MYRTACEÆ are in Australia within the tropics, where they do not prevail over other forms of vegetation to the extent they do in temperate regions. The genera of Myrtles with fleshy fruits are the members of the order best represented in the Malaysian region, but in Australia such are almost entirely confined to the tropics. On the other hand, the characteristic MYRTACEÆ of Australia are those with capsular fruits, and they are nearly entirely confined to that continent, though there are a few stragglers to be found in the flora we are now considering. There is a *Metrosideros* in the Malayan Peninsula, and I found on the summit of Gunong Bubu a *Leptospermum* and a *Leucopogon*. The MELASTOMACEÆ of Australia are few in number, not exceeding five species, belonging to four wide-spread genera, namely,



*Osbeckia*, *Melastoma*, *Otanthera*, and *Memecylon*. One species of *Osbeckia* common in Malaysia extends to Australia. The Australian *Otanthera* is wide-spread in the Indian Archipelago, and *Memecylon umbellatum* was also recognised in the Peninsula. *Melastoma* is the only species of the order which extends outside the tropics in Australia.

The useful properties of this order are few. They are generally astringent, and one or two produce edible fruits. Black and yellow dyes are extracted from the berries of American and Malaysian species. The leaves of *Melastoma malabathrica* are said to be efficacious in dysentery. *Astronia papetaria* is a Malayan species with sub-acid leaves, and is cooked with fish. It is called Obat papeda.

Most of them have showy blossoms of pink and violet tints, which are a great embellishment to the vegetation of Malaysia. Some species of *Medinilla* are climbers and cover the trees with a profusion of scarlet blossoms, while the stalks of the whole raceme are a brilliant coral red, carmine or pink. See Curtis's "Botanical Magazine," where there are beautiful figures of *M. speciosa*, *M. magnifica*, *M. javanensis*, *M. curtisii*, *M. amabilis*, and some others.

PALMS.—This natural order in Malaysia requires a special essay to itself to do it justice. The whole scenery of the Malayan region is modified and characterised by its palms. It is usually a fringe of Cocoa-nut Palms which lines the coast. Even where the Mangroves form a soft green margin, the Cocoa-nuts project their feathery heads above the line of trees and give a tropical character to the scene. Cocoa-nut Palms are soon discovered to be everywhere. They line the coast, they crowd the valleys, they shade the sand-hills, and they form the borders of both the roads and the garden enclosures. There are plantations of this palm besides, near the towns, where nothing else grows by its side except the Betel Palm. And this also grows everywhere. It is just as well that it is so, for the Cocoa-nut Palm is apt to become

straggling, and its stately dignity much impaired by its faded look. Betel Palm is gracefulness itself. Tall, slender, fresh-looking and green, with a close luxuriant tuft at the summit of arched or straight leaves, it forms one of the very agreeable embellishments of the tropical flora. The foliage is like a plume of feathers around a warrior's helmet as it waves to and fro in the breeze. It is seen almost everywhere, and is always an index of cultivation. In wandering through the jungle when one gets a sight of Cocoa-nut Palms or Betel Palms, one may be sure that there is, or there has been, a native settlement in the locality.

Everyone knows the purpose for which Betel is cultivated. The seed is cut into small slices, mixed with lime and wrapped up in a leaf of Sirrih or Betel pepper, and is chewed by the natives. It is an acquired taste, and one would say not easily acquired, yet the practice is universal, and the natives would forego anything rather than this luxury. A curious fact connected with the Betel is the uncertainty about its habitat. Somewhere in Malaysia, is the conclusion arrived at, but one never sees it in a wild state. The Chinese historians state that it was received from the south B.C. 111 years, and then it bore the name of Pinlang; now, the native name is Pining; in Javanese, Jambi; in Balinese, Banda according to Crawford, who also says the Bugis call it Rapo; in Tagalo, Bonga and Bongang-pato, also Sacsic. In all the Philippine dialects it should be remarked, however, that Bonga means simply a fruit. The Sanskrit name is Gouvaka (de Candolle). The Telinga name, Arek, is the origin of the botanical name *Areca*, while Betel is the Malabar name. In Hindostanee it is called Paunsooparee or Paun, but this refers to the prepared state of the Betel-nut, lime and pepper leaf.

The spathe of the leaf contains valuable fibre deserving the attention of paper-makers. The Chinese storekeepers in Singapore and Penang use it for packing, and in India it is employed for many purposes, even water-vessels, caps, umbrellas, &c. It has a fine surface like paper.

*Borassus flabelliformis*, or the Palmyra Palm, is seen sparingly near the coast in the Malay Peninsula. It is not common any

where in this region, but most frequent in Java. The leaves are over eighteen inches in diameter, folding and opening like immense fans. The upper enamelled surface is written on with an iron stylus, and forms the Balinese books, remaining in good preservation for hundreds of years. The ribs being of cane give great strength to the leaf. Cut off at the stem, the thicker part of the fan is bent round, making a powerful helmet used by fighting men, and as a protection for those who force their way through the jungle, for which the wedge-like form is admirably adapted. Furthermore, it serves as an umbrella. It is said to yield its fruit only when the tree is eighty years old, when previously a flower, about thirty feet long in large trees, bursts forth with a loud report. Its perfume is overpowering, which causes the natives to destroy them. This tree is used for the production of sago from its pith, but only in times of scarcity. The leaf-stalks yield a wiry fibre about two feet in length, made into rope occasionally. A fine down is collected from the base of the leaves, valued for staunching wounds and straining liquids. In Bengal the juice is fermented for toddy, and is used for yeast and yields a sugar of grey colour. A more common and more valuable palm is the Gomuti, Jaggery, Kabong, Areng or Aju, known to Europeans as the Sugar-palm and to botanists as *Arenga saccharifera*. It is a magnificent tree, with close long pinnae on the leaves, less stiff and regular than the Coconut Palm. There is more than one species of Areng extending to nearly 3,000 feet above the sea level, but the Sugar-palm loves low moist situations, and is quite content with the poorest soil. It vies with the Cocoa-nut Tree in utility. In Java it is common on the road-sides in the mountains, but not so common anywhere as it ought to be. It produces valuable supplies of sugar, fibre, spirit and sago, but the sugar is the great production. This is yielded by the male spadix (in Malay Mayam), but not before the tree has attained its seventh year, and even then male spadices are rare or absent; but if absent the tree is abundantly rich in sago. The Mayams, both male and female, have a handsome appearance as they hang down in clusters or strings of rich-looking buds. Curious things are related of them, such as, that each new sprout-

ing of Mayam is lower and lower, and till the last comes forth at the root of the tree and it then dies. Generally two male spadices come forth at a time and they yield juice from three to five months, and, ere they cease, their places are supplied by fresh ones. When the flower opens the spadix is cut at the base, and tubes of seasoned or smoked bamboo (from which the upper phragmata are removed, making a long vessel), are applied. As they fill the juice is poured into earthen jars, and evaporated in iron pans over a fire until nothing but grain-sugar remains.

If toddy be wanted, the spadix is tied at the base and beaten with a small stick for two or three days in succession, and the juice collected in the usual way. It is left in jars until fermented, in which state mostly it is taken by the natives. In the Philippines it is consumed largely and I believe to intoxication. I have seen the natives lying about in a stupid state of inebriation from its use, especially the old men. It has a flavour which suggests beer, vinegar and malt, while there is a general aroma recalling the smell of a brewery and mouldy wood. A powerful spirit is distilled from it, largely used by the Chinese in Malaysia, and to some extent abused also.

Dr. de Vry, a Dutch naturalist from Batavia, strongly recommends the employment of *Arenga* for the sole production of sugar; as he says the tree takes nothing from the soil, while beet and cane utterly exhaust it. He calculates that three quarters of an acre planted with Gomuti should yield annually 2,400 kilogrammes of sugar in a soil quite unfit for any other culture. I am not aware of the number of trees or their distance apart in the supposed area.

The Jaggery also produces sago; in fact no other tree is the source of it in Java; but it is dark in colour, of poor quality and small in quantity in proportion to the yield of other palms. In Sunda it is the only sago offered in the markets; but in eastern Java other kinds are imported.

The enumeration of the useful qualities of this Palm-tree is not yet finished. The stem of young trees is wrapped round in the leaf-sheaths, the sides of which afford a black fibre like horse-hair, to

the extent of about three-quarters of a pound to each leaf. This falls away of itself and is easily collected without injury to the tree. Some is coarse like elephants' bristles, and some so fine as to be good for stuffing beds; but the greater part is like horse-hair, making a beautiful rope. It bears a greater strain than coir, and loses less weight than coir, hemp or Manila hemp, as it requires no preparation for manufacture, and water has no effect upon it. It would be superior to every other kind of fibre for ropes, were it not that it is not sufficiently elastic for anything but standing rigging, cables and such-like purposes.

I conclude this summary of the value of Gomuti with the words of Dr. Roxburgh: "I cannot avoid recommending to every one who possesses land in India, particularly such as is low and near the coasts, to extend the cultivation of this useful and elegant palm, as much as possible. The wine itself and the sugar it yields, the black fibres for cordages and cables, and the pith for sago, independent of many other uses, are objects of very great importance. From observations made in the Botanic Gardens at Calcutta, well-grown thriving trees produce about six leaves annually, and each leaf yields from eight to 16 ounces of the clean fibre. They are in blossom all the year; one lately cut down yielded about 150 lbs. of good sago meal."

SAGO PALM.—In 1475, Marco Polo wrote as follows:—"And I will tell you another great marvel; they have a kind of tree that produces flour, and excellent flour it is for food. These trees are very tall and thick, but have a very thin bark, and inside this bark they are crammed with flour." This is the first accurate description of the *Sagus levis*, Reinw., by that most accurate and painstaking of travellers. Twenty feet is about the average height, and the tree is generally surrounded by numerous young plants. The stem is very thick with annular leaf-scars on the upper part. The leaves are like those of the Cocoa-nut but grow more erect; they are pinnate, unarmed; leaflets linear, acute, carinate and smooth. This tree is not matured till it is about seven to 20 years old; the fructification then appears and it soon



after decays and dies. The inflorescence is terminal; several spadices rise from the summit of the stem, enveloped in sheaths at their joints, and are alternately branched. The flowers and fruit, generally five to eight inches long, are produced on these branches. They are brown, closely imbricated with broad scarioso scales, within which is a quantity of ferruginous flocculent fibre or wadding, in which the minute flowers are embedded and completely concealed. Each scale supports two flowers which are hermaphrodite, and scarce larger than a grain of turnip-seed. In habit and character this tree differs much from all palms, and its propagation by radical shoots like the Banana is not observed in any other species. The terminal blossoms and the death of the tree after fructification are other peculiarities. The fruits are retroversely imbricated like the rattans or *Calamus*. In its young stages the stem is covered with sharp thorns, no doubt to protect the tender tree from destruction, as they fall off subsequently. It grows best in muddy marshes, and will not do well anywhere else. The sago must be gathered before the fruit forms, as then the stem consists of a thin wall enclosing a wide mass of pith. This is the flour which requires other preparation before it becomes an article of export. The natives call it Sagu. It is eaten with palm-sugar and forms a dish called Santan, very luscious and nourishing with cocoa-nut milk (the juice of the nut expressed with water, not the contained fluid), but probably too sweet for European palates. The flour is also baked in biscuits which keep well. The fruits of the tree are eaten and easily preserved, 30 baskets being no uncommon harvest for one tree, and a basket giving ample nourishment to a small family for a week. Neither fruit nor sago is much used by the natives except in Celebes, and the Philippines and Moluccas.

It would be useless to enter into detail on the mode of preparation, which is described by so many authors. At present the product gives rise to industries in many parts of the Indian Archipelago, particularly Malacca, Sumatra, certain parts of Perak, Selangore, Borneo, &c. In Singapore there is an extensive trade in sago, whence it is exported after being bleached and

pearled for the European market. When I was in Borneo there had been a great advance made in the sago trade, through the influence of the North Borneo Company, owing to the efforts of the Government of Sarawak, and arrangements between Labuan and the Sultan of Brunei. At the latter city I met with a few Europeans who were trading with certain Chinese merchants and manufacturers in Brunei for sago. I visited one Chinese establishment where there was rather a small plant for bleaching and pearling, and I heard of others; but owing to the unsettled state of affairs, and the war between the Sultan of Brunei and the Kadyans, there was a general exodus of Europeans from the kingdom.

Crawfurd states that by far the best and fullest account of the culture and manufacture of sago is given by Mr. Logan in Vol. III. of the "Journal of the Indian Archipelago;" but readers will do well also to consult Simmonds' "Tropical Agriculture" (London, 1877), and Spon's "Encyclopædia of Manufactures and Raw Materials" (London, 1882) for an account of the cultivation.

The following quotation from Logan deserves insertion:—  
"When a plantation has once arrived at maturity there will be a constant harvest, because the natural mode of growth secures a continued succession of new plants from the time those first planted have begun to extend their roots, and this succession can be regulated by the knife in any manner the planter desires. The Sago Tree, when cut down and the top severed from it, is a cylinder about 20 inches in diameter, and from 15 to 20 feet in height. Assuming 20 inches as the diameter, and 15 feet as the height of trees, the contents will be nearly 26 bushels, and allowing one half for woody fibre, there will remain 13 bushels of starch, which agrees very closely with our previous calculation of 700 pounds for each tree, or  $12\frac{1}{2}$  bushels. It may give some idea of the enormous rate of this produce if it be considered that three trees yield more nutritive matter than an acre of wheat, and six trees more than an acre of potatoes. An acre of sago, if cut down at one harvest, will yield 5220 bushels, or as much as 163 acres of wheat, so that according as we allow 7 or 15 years for

the growth of a tree, an acre of sago is equal in annual produce to 23 or 10 acres of wheat." ("Journal of the Indian Archipelago," III., p. 312).

The manufacture of pearl sago by the Chinese is described fully in the works already cited. Though *Sagus levis* or *S. kœnigii* is the species most used for the production of the farina, there are probably three or four species and a number of varieties known to the Malays. There is what is called a bastard sago, derived from the Toddy Palm (*Caryota urens*), a native of the mountains of India and Ceylon. Another sago is made from a distant relation of the palm family in Japan (*Cycas revoluta*). There is also an extensive trade in Brazilian sago, derived from *Copernicia cerifera*. *Cycas circinnalis* yields sago in Malabar and Cochin China.

A few words more about some well-known species in Malaysia must conclude the references to the palms. Certain species frequent certain altitudes. In an expedition to Gunong Bubu I met with three palms clothing the mountain side, almost to the exclusion of any others up to about 3,500 feet. For the first 2,000 feet we had the usual mountain species of *Arenga*, *Areca* or Betel, and *Ptychosperma*, with occasionally the less common genera of the plains. At 2,000 feet or so we began to meet with abundance of *Pinanga*, or *Ptychosperma*, with which genus it has been united. The large pinnæ were especially useful for roofing our temporary huts. They are unarmed, often arboreous palms or shrubs, sometimes with creeping stems. There are several species such as Pinang boreng of Malacca, and Kurdu at Penang. Many persons think that this particular species produces those formidable palm-tree bludgeons which are known in the Straits Settlements as "Penang lawyers;" but it cannot be the Pinang boreng which is *Areca (Pinanga) malayana* (Mart. Palmae, p. 184, pl. 158, fig. 3, and Griffith, "Palms of Brit. E. India," p. 152, pl. 230). It is an elegant palm eight to twelve feet high, with a distinctly annulate stem scarcely an inch in diameter, and a crown of five to eight spreading leaves with stalks a foot and a-half long, while the

alternate linear pinnules are one and a-half to two feet long ; upper pinnules cuneate and deeply bipartite.

Above this region of *Pinanga* is the Bertam Palm, a stemless species, growing in thick tufts which are surrounded by the withering fragments of old leaves. This is the *Eugeissona triste* (Griffith, p. 110, pl. 220, A. B. C.) The leaves are numerous, the outer ones spreading, and fifteen or twenty feet in length. The stalks throughout the lower seven or ten feet are roundish, armed with brown, flat ascending thorns ; but between the pinnules they are triangular and unarmed ; the pinnules long and narrow, 25 or 30 inches in length. This is one of the most useful of palm-trees and in its industrial application it divides the honours with *Nipa fruticans*. Most of the partitions of houses are made of it, and often the walls ; while the leaves with the pinnules plaited over one another make a very effective roofing. It is common everywhere in the Straits Settlements, and adds much to the impenetrability of the vegetation. The Bertam continued up to about 3,000 feet and then we had nothing but *Licuala*. These were very handsome trees even though they are almost stemless, but as the leaves are fan-shaped or sometimes circular the appearance is very elegant. The natives call them generally by the name of "Plass," but most of the species occur on the lower grounds in wet places. Here, however, I met with them on dry slopes, altogether above the usual region of palms, and this was quite a discovery. The leaves were circular and peltate, and I have little doubt that this was *Licuala peltata*, a species peculiar to the woody mountainous country of the Himalayas below Darjeling. I never saw it anywhere except on this mountain, nor below a height of 3,000 feet ; but I must add that my experience of mountain ranges was somewhat limited in the Malay Peninsula. Griffith says that this is the largest and finest species of the genus, and not likely to be confounded with any other. Its large peltate orbicular leaves, simple, large pendulous spikes, and comparatively very large flowers will at once distinguish it. In its leaves it resembles *L. longipes*, but that is an almost stemless palm, while this, though a low species, has a stout stem

three or four feet high, marked below with leaf-scars, but above the base of the petiole is persistent. It is used as an umbrella or parasol, and is called on that account the Chattah pat, chattah being an umbrella in Assam. The demand for them is great; scarcely a single ploughman, cow-keeper, or coolee but carries a sunshade made from this tree in Assam; but in Malaysia it is not so used.

*Licuala acutifida*, or, in Malay the Rat-plass (*Plass tisku*), appears to be the plant supplying the "Penang lawyers." It is a small miniature palm, the trunk being only from three to five feet high, though specimens may be obtained 15 or 20 feet in height and about two inches in diameter at the base, marked with incomplete rings to which fragments of the leaf stalks adhere. Some think that the best of "Penang lawyers" are those which are stoutest and most bludgeon-like; but this is not the case, because of the way in which they are prepared. Nearly the whole of the outer layer is removed almost to the pith by scraping and polishing. They thus become brittle and easily decayed. The thinner sticks are much more valuable and are more rare. Scraping and straightening over a fire is the only preparation these sticks appear to be subjected to. The species is not common and has a restricted habitat, though probably not entirely confined to the neighbourhood of Penang or the province of Wellesley.

On the borders of paddy-swamps throughout the Peninsula there is a very elegant palm 30 or 40 feet high, annulate, and each ring beset with spines with a dense and graceful foliage. This is the Nibong Palm of the Malays, or *Areca tigillaria*, not to be confounded with Nibong Paday, or *A. horrida*, common on the cliffs of the sea-shore a little to the north of Kundur, near Malacca. The first species mentioned is much in request for door-posts. Nibong tubal is the name of a somewhat large village (tubal, thick) in the province Wellesley.

*Orania macrocladus*, the Daun daun or Ebul of the Malays, is a handsome palm about 40 feet in height resembling a Cocoa-nut



tree. It is common in the forests at Ching, near Malacca, and met occasionally in the Peninsula and in Singapore Island. *Caryota urens*, or the toddy-palm, is met with in situations which suggest former cultivation, besides *C. sobolifera*, *C. obtusa*, and *C. cumingii*. I am not aware that the natives make any use of these trees. *Ptychosperma singaporensis*, a species which closely resembles the common palm found on the north and east coast of Australia down to lat. 34° south, is frequently met with in the Peninsula, in fact is the most abundant of indigenous palms. Another species, *C. coccinea*, is rather rare. *Cyrtostachys rendah* is one of the ornamental palms in the jungle of the Peninsula. The Malay name is Malam waren. It has a beautiful red hue, and though not ever assuming the proportions of a tree, its pinnate fronds are disposed in such a way as to render it very elegant and graceful. When in Labuan, Borneo, I saw this species growing apparently wild in the jungle close to Government House.

CUPULIFERÆ, AMENTACEÆ, OR CORYLACEÆ. — Chestnuts and Oaks form a considerable portion of the indigenous flora of the mountain forests, extending at least up to 3000 feet. The species are numerous, and probably many are undescribed. The Oaks differ from the European species. The acorns are mostly depressed, round and oval, so as to form almost a disk an inch or two across, and the cup is either covered with imbricated scales or overlapping lines of the involucre forming a series of rings. A figure of one of these is given at the end of the chapter. I am not aware that any of the species are valued amongst the Malays on account of the timber they yield. The species of *Castania* or Chestnuts are nearly as numerous as the Oaks, if not quite as many. They have been divided into two genera by some authors, namely, *Castania* and *Castanopsis*. The distinction is derived from the ovary and the involucre. In *Castanopsis* it is 3-locular, and the spinous involucre altogether encloses the fruit, finally splitting open irregularly. In *Castania* the ovary is 6-locular, and the thorny involucre includes one or two nuts, and opens

regularly into two or four valves. *Castanopsis* includes all the species found in the oriental region, 24 being enumerated between India, China, and Malaysia; in fact there is only one other. According to Bentham and Hooker there are but two species of *Castania*, one of which is the well-known edible Chestnut. No true *Castania* therefore exists in the Malay Peninsula. *Castanopsis argentea* occurs as high as 6,000 to 7,000 feet in Burmah. The timber is valued to some extent, especially in Java, and the fruit is used in the same manner as the European Chestnut. Sanienten appears to be the Malay name, and Tangogo in Sunda. In Tagalo and Visayan Oaks are called Olayan, Hayopag, Macabingao, Mangasariqui, Cacana, Palayen. The *Castanopsis* in Tagalo is Talacatac and Tacatac. There are but two or three species of *Castania* in the Philippines, and the Oaks are somewhat more numerous, but they do not occupy so important a position in these islands as they do in Malaysia. Nearly all the fruits of the Chestnuts of the forest are used as articles of food, in Java and Sumatra especially, but they are not cultivated.

CREEPING OR CLIMBING PLANTS.—The vines of the jungle form so large a portion of the vegetation that to enumerate even a fair percentage would far exceed the limits of this essay. Only a few of the leading genera can be mentioned, for the climbing shrubs range through every natural order, not even excepting the Cryptogams. *Lygodium scandens* has already been mentioned. *Freycinetia* is a common climbing Screw-pine, *Calamus* a climbing Palm, and *Vanilla* a climbing Orchid; and as for the climbing Aroids they are innumerable. This will serve as a specimen for the endogens. As for the exogenous climbers only a very few can be named. Several species of *Cocculus* and *Anamirta* are common. The latter is the source of the bean *Cocculus indicus*, used in beer to increase its stupefying qualities and as a fish-poison. *Cocculus glaucescens* is another common species, the fruit of which is eaten readily by the natives and is said to be agreeable and refreshing. *Naravelia zeylanica* is an inconspicuous climbing

plant of the order RANUNCULACEÆ, with star-like yellow flowers, distinguished from *Clematis* by the presence of petals. It extends through all the Eastern Archipelago. *Delima* or *Tetracera sarmentosa* is universally met with, belonging to the order of DILLENIACEÆ, already referred to as used by cabinet-makers as a substitute for sand-paper ; besides several fir-trees. *Tinospora crispa* and *Cissampelos paraira* are two other climbers belonging to the MENISPERMACEÆ. The first yields the Galuncha drug to the natives of the Indian Peninsula, who attribute to it many medicinal virtues ; the second produces the Portuguese remedy known as Pareira-Brava. *Fibraurea tinctoria*, another member of the order, called Akar by the Malays, is common, yielding a dye from its root. *Schizandra marmorata* (MAGNOLIACEÆ) is a somewhat rare climber with red, yellowish, or white flowers : an infusion of the roots is used for dysentery or colic.

The climbing Leguminosæ are very numerous. The large pods of *Entada scandens*, which contain beans made into match-boxes both in the Straits Settlements and in Australia, are common. The appearance in the jungle of the skeleton pods is very peculiar, as the sutures of the coriaceous pod remain upon the tree after the seeds have fallen away, looking like a miniature ladder. It is widely diffused over tropical Asia, Africa, and the West Indies, the seeds being carried by ocean currents without losing their power of germination. *Derris scandens* and *D. uliginosa* are tall woody climbers distinguishable by the sutures of the flat pod being bordered by a narrow wing, with white or yellowish axillary racemes of flowers. Both species, wide-spread throughout the Archipelago, are used as fish-poisons. *Canavalia obtusifolia* has the stems more frequently prostrate and trailing than twining, with white or slightly pink flowers and winged pods, but distinguished from *Derris* by having pinnate leaves with five or more leaflets, and a divided reputation either as an esculent or a virulent poison. *C. ensiformis* can certainly be used as an esculent, as the leaves, pods, and unripe fruits are cooked by the Malays with rice and eaten. Among the Cæsalpineæ three or

four if not more species of *Bauhinia* are commonly met with. *B. tomentosa* affords a remedy for dysentery, while the seeds afford the medicine named the Downy Mountain Ebony Oil.

The PASSIFLORACEÆ are well represented by climbers in the jungle including *Passiflora foetida*, as well as *Modecca obtusa* with its large scarlet capsule, which is common and brilliant. CUCURBITACEÆ will be easily recognized by their gourd-like fruits, including the Gourd itself (*Lagenaria vulgaris*), which grows wild in the jungle as it does in North Australia. It is not very palatable, but still the natives use it as food, and uncooked the pulp is taken as a purgative. Most botanical works state that it is poisonous, but this is incorrect. *Momordica balsamina* is widely spread, and is conspicuous from its long fusiform bright yellow fruits, which bursting disclose the seeds enveloped in a brilliantly red pulp.

True Vines of the natural order AMPELIDEÆ are especially common, including *Vitis elegans*, *V. hookeri*, *V. gracilis*, *V. semi-sagittifolia*, *V. trifolia*, *V. lanceolaria*, *V. capriolata*. They all have fruits, and some, large bunches of a very enticing-looking grape, but generally astringent and nauseating. *Pæderia foetida* and *P. tomentosa* are common, the former with its fetid odour being unmistakable. Three species of *Willoughbeia*, (*W. firma*, *martatanica* and *flavescens*) represent the scandent Dog-banes, with very large apple-like fruits, said to be good eating; but the order is a suspicious one. *Ichnocarpus frutescens* is another of its members. Passing from the Dog-banes to the ASCLEPIADEÆ we find a larger allied order more extensively represented, including as common members of it, *Streptocaulon bannii*, *Tylophora tenuis*, *Gymnema syringifolium*, and the Hoyer or Wax-plants (*H. pratense*, *H. imperialis*, *H. lacunosa* and *H. carnosia*) distinguished by their fleshy wax-like leaves and clusters of beautiful fragrant flowers. These plants prefer to grow like Orchids on rocky outcrops. The LOGANIACEÆ are also represented by climbing *Fagraea*, notably *F. auriculata*, a fragrant species with cream-coloured flowers fully five inches across. *Strychnos colubrina* is a climber everywhere

abundant, with poisonous qualities which seem to be well-known to the Malays.

The CONVOLVULACEÆ are amongst the principal adornments of the jungle, from *Ipomœa bona-nox* with its large white salver-shaped flowers to *I. quamoclit* with small brilliantly carmine blossoms and leaves with minute pinnae. There are also representatives of the order all through the jungle, of which *I. pes-tigridis* is the most common; it is found everywhere, with its five-lobed palmate leaves and funnel-shaped purplish flowers, twisted together so as to form ropes which strangle many a fine young tree. The species (a variety) is equally common in Hong Kong.

The BIGNONIACEÆ are not well represented in the Malayan flora; but observers will be sure to notice *Bignonia unguis* which is common everywhere. Almost as common is *Grewia umbellata*, a tiliaceous climber of which there are others in the jungle. *Hexacentris mysorensis* is an ornamental climber of the order ACANTHACEÆ. It has dentate leaves and many-flowered axillary racemes of handsome blossoms. A *Smilax* or two, which the Malays call Pina-pina, contribute their tendrils and binders to the tangled intricacies of the Malayan thickets. Finally two Aroids are noticeable by the way they grow up the stems of trees and clasp them with the tenacity of the ivy of Europe. One is *Pothos loureiri*, a smooth climber with the leaves usually arranged longitudinally in two rows on the opposite sides of the stalks. The leaves moreover have the blades fixed by a joint to the stalk, and the stalk itself is spread out like a leaf. The species is in Australia, the Philippines and south China, as well as Malaysia. The other Aroid is *Rhaphidophora pinnata*, which climbs on trees, rooting in the lower part of them; but the leaves are deeply lobed, often three feet long and one broad, the segments being narrow and curved, with more or less incurved points. This species is called by Europeans the Climbing Fern, and is found in Australia as well as in the South Pacific Islands.

PARASITES OR EPIPHYTES.—Plants growing on others and deriving nourishment from their sap, or plants which grow on the



surface of others without deriving anything from them, are extremely common in this region, especially if we include the Fig-trees. But even exclusive of the Figs, the Mistletoes and similar plants, such as *Viscum*, *Ginjalloa* and *Anginjalloa*, are abundant in the jungle. The species of *Viscum* or true Mistletoe which are found in the Indian Archipelago belong to the leafless group, and these, like those of Mauritius and Australia, *V. compressum* and *V. ramosissimum* are common with *Loranthus tetragonus*, *L. formosus* and over twenty other species on different trees. This exceedingly difficult genus has its species so closely resembling one another, and so many varieties that they require great experience to distinguish them, especially where they are so numerous.

ORCHIDEÆ.—There is no department of the vegetable kingdom that attracts so much attention in Malaysia as this natural order. They are interesting in their habit; they grow so easily, requiring little attention, and can be put almost anywhere, and they often produce flowers pre-eminent in their form, colour, and fragrance, that nearly every one collects them amongst the European residents. They hang them in their verandahs or amongst their flower-pots, and are often rewarded by seeing the fairest blossoms open from what look like dry and shrivelled stems and roots. Scarcely a bungalow in the European quarters but contains a goodly show of these odd plants, though they are not ornamental unless when in flower. Yet it may be questioned whether there are many who make these collections who have the most elementary knowledge about the nature of the plants. They would find it extremely difficult to give a definition of what an Orchid is. Most amateurs believe that their epiphytic character is a distinctive mark belonging to the order. This is not a matter of surprise in Malaysia, where ground Orchids are rare, and nearly all the species are epiphytal, or grow on stones. The fibrous roots in bundles which clasp the stems of the trees to which they grow, or which hang loosely in the air, or are fleshy tubers and filled with granules of bassorin (a soluble gum like tragacanth), are marks distinct enough in the eyes of amateurs

in Malaysia to denote an Orchid. The irregular flowers, however, demand a word of explanation. They differ from the plan which prevails in the vegetable kingdom, and their organs are arranged on a uniform plan of their own. This consists of three sepals, between which are three petals, the two lateral ones similar, and like the dorsal sepal, so called because it is placed at the back of the flower. The third petal is the largest, and differs in shape and has various appendages. Instead of having a style and stamens like other flowers there is a body in the centre called the column. The pollen is in wedge-shaped masses, two or more in number, detached, or adhering by a stem. The stigmas are confluent, in a hollow mucous disk. The ovary has one cell opening eventually into six dry woody valves with horizontal cells, three of which contain minute seeds in a loose netted skin. The special peculiarities of the order are :—(1) the union of the stamens and style into the column ; (2) the suppression of all the anthers but one (except in *Cypripedium*) ; (3) the peculiar condition of the pollen ; (4) the development of one of the petals into a large and peculiar form.

Orchids are divided into seven tribes thus :—three with pollen masses, namely, (1) MALAXIDÆ, with no stem or caudicle to the pollen masses which are immediately applied on the stigmata ; anther hanging down like a lid, usually deciduous (two, four, or rarely eight) ; (2) EPIDENDRÆ, pollen masses with caudicle, but no separable stigmatic gland ; (3) VANDEÆ, pollen masses in two pairs on a single or double caudicle attached to a gland. Four tribes have powdery or granular pollen, namely, (1) OPHREÆ, anther terminal, erect ; (2) ARETHUSEÆ, anther terminal, lid-like ; (3) NEOTTEÆ, anther dorsal ; (4) CYPRIPEDEÆ, anthers two.

Orchids are tropical in this sense that they are more numerous in tropical regions than elsewhere. The MALAXIDÆ prevail principally in the Indian continent and Malaysia, being less numerous in tropical America and the islands of South Africa. They extend likewise to Australia and the Pacific Islands, but are completely absent from the Mediterranean, extra-tropical

America, and the Cape of Good Hope. They have a large number of genera, the most notable of which are *Dendrobium* (a very large genus generally belonging to Malaysia, the majority with purple or yellow flowers, some remarkably showy and some of delightful fragrance); *Dendrochilum* (a small Malaysian genus on branches or trunks of trees, with bulb-like roots and a single shiny leaf and long spikes of small white and yellow flowers, some like lilies of the valley and very graceful); *Aporum* (flowers small and of no great beauty); *Bolbophyllum* (a large genus of small size on trees or rambling on the ground amongst mosses, with one leaf, a kind of bulb with small fleshy deeply-coloured flowers, in dense spikes occasionally); *Cirrhopetalum* (another genus with solitary leaves and pseudo-bulbs, with the lateral sepals of the flowers prolonged into narrow streamers, hence the name); and *Eria* (likewise a large genus with flowers sometimes remarkable for their fragrance, but not of great beauty. It takes its name from the Greek "επιον, wool, because many species have the flowers clothed with white down).

The EPIDENDRÆ are epiphytes rarely having fleshy roots, conspicuous for large coloured membranaceous flowers, with a great lip curved in like a hood, bearing fringes on its veins, and a broad column. *Pholidota* with pseudo-bulbs or fleshy jointed rhizomes; *Spathoglottis* a native of Malacca, China, India and the Philippines, with a few pretty species of yellow and crimson; *Phaius* with large and showy flowers, spread over tropical and sub-tropical Asia. *P. grandifolius* is found in Australia, and even New South Wales, as well as Malaysia. Generally speaking the EPIDENDRÆ are tropical American.

The tribe VANDEÆ are pretty equally divided between the tropics of America and of the old world, and very rare elsewhere. Amongst the most ornamental are *Eulophia* with a handsome crest in elevated ridges on the labellum, and *Vanda* (the Sanskrit name of the original species of this genus) with deliciously fragrant as well as beautiful flowers. There are about a dozen, if not more, Malaysian species in cultivation. *Renanthera* so-called from the

kidneyshape of the pollen masses. *R. coccinea*, probably indigenous, but at any rate cultivated in Singapore (from Cochin China), is a splendid plant; the loose lateral panicles of flowers have the sepals of a pale blotched scarlet, and the petals and labellum a brilliant yellow and scarlet. *Saccolabium* is beautiful and interesting; some species will produce from 30 to 100 spikes of flowers every season. There are eight or ten highly ornamental kinds in Malaysia. *Sarcanthus* is equally prolific and quite as showy. *Ecceclades* has probably one or two fine plants undescribed in the Peninsula. *Angraecum* is an African genus the name of which is Angurek amongst the Malays. The species are very ornamental. *Acanthophippium* has pseudo-bulbs instead of tubers with rich flowers produced near the base of the shoots. One very fine crimson rose species is cultivated from Java. *Calanthe* the name of which (beautiful flowered) tells its character, has many species in Java, Japan and the Straits Settlements, all especially attractive. *Phalænopsis* (from *φάλανα* a moth) so called from a fancied resemblance to a butterfly, is a beautiful plant, commonly called the Indian Butterfly Orchis. The flowers are large and either white or yellowish, produced on an erect spike; there are also pink and purple species, only a few of which have been described. Borneo is said to be especially rich in species.

The OPHREÆ are rare in the tropics, and also the tribe ARETHUSEÆ; though *Vanilla* is a genus which has been introduced and is sometimes seen in the jungle. The NEOTTEÆ grow principally in extra-tropical Asia and Australia, except one genus *Anæctochilus*, a terrestrial orchid with creeping slender jointed rhizomes and spikes of white or yellow blossoms and radical leaves. Some are traversed by glistening silver or golden veins on a rich green or purplish ground. An allied genus (*Physurus*) has its leaves similarly veined; the commonest species is *P. pictus*.

*Cypripedium* is a remarkably handsome genus, constantly met in cultivation. They are not confined to the tropics; but are particularly well represented in Malaysia.



The following is a list of the principal orchids which are worthy of attention in the Malaysian region.\*

*Dendrobium acerosum*, flower yellowish and pink; Singapore. *D. aciculare*, yellowish; Singapore. *D. acuminatissimum*, greenish; Manila. *D. aduncum*, pink; Manila. *D. affine*, white and brown; Timor. *D. albo-sanguineum*, white and red; Malay Peninsula. *D. amboinense*, rose; Amboyna. *D. anosmum*, purple; Philippines. *D. auriferum*, yellow; China and Malay Peninsula. *D. calcaratum*, green; Singapore. *D. criniferum*, yellow; Ceylon. *D. crumenatum*, white; Sumatra. *D. cucumerinum*, colour?; Malaysia. *D. violce-odorum*, white; Java. *D. cumulatum*, pink; Java. *D. cymbidioides*, deep yellow; Java. *D. dayanum*, colour?; Java. *D. discolor*, yellow and brown; Java. *D. erosum*, colour?; Java. *D. excavatum*, colour?; Java. *D. flavescens*, yellow; Java. *D. gemellum*, yellowish-green; Singapore. *D. glaucophyllum*, colour?; Java. *D. glumaceum*, green; Philippines. *D. hasseltii*, purple; Java. *D. hymenophyllum*, colour?; Java. *D. junceum*, green; Singapore. *D. kuhlii*, pale purple; Java. *D. longicolle*, streaked with purple;

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\* The discovery of a new species of *Cypripedium* in the Malay Peninsula deserves some mention here, as unquestionably the small group of Malaysian *Cypripedia* is the handsomest of the genus. The new species *C. sanderianum* is probably the most wonderful-looking flower in an order where wonderful structures are the rule. The leaves are long, broad, and of bright green colour, shining as if varnished. The flower stems are deep reddish-purple, with velvet covering, bearing from three to five flowers. The green bracts are purplish outside, striped with darker purple within and ciliate at the edges; sepals very concave, triangularly lanceolate, covered with stiff hairs and dark purple veins: petals linear like long dependent thongs some 18 inches in length, broader at the base, with transverse lines of rich red, mottled with pale cream colour. The thong-like portions are blackish purple with peculiar rounded, slightly swollen terminations. The long dependent curled and almost snake-like petals, as they are seen emerging from the half-open buds, are very singular and beautiful, and must be seen to be appreciated. The group of Malaysian *Cypripedia* includes only about nine species, namely—*C. platytænium*, *glanduliferum*, *philippinense* (or *laevigatum*), *haynaldianum*, *parishii*, *roebelenii*, *stonei* and *lowii*. All differ considerably from other *Cypripedia*, having their counterpart in the *Selenepedia* of S. America. *C. sanderianum* is a near ally of *C. roebelenii* and *C. philippinense*. (See "Reichenbachia," by F. Sander, Pt. I. May, 1886, p. 7).



Singapore. *D. lowii*, yellow; Borneo. *D. macranthum*, lilac; Luzon; Philippines. *D. macrochilum*, rose; Luzon. *D. macrophyllum*, purple; Philippines. *D. giganteum*, rose; Philippines. *D. miserum*, white; Philippines. *D. mutabile*, rose; Java. *D. nudum*, pale purple; Java. *D. pictum*, crimson; Borneo. *D. latifolium*, pale rose and yellow; Singapore, var. with green flowers at Manila. *D. planibulbe*, purple and white; Luzon. *D. plicatile*, yellow and red; Luzon. *D. revolutum*, straw-coloured; Singapore. *D. rhombeum*, pale yellow; Luzon. *D. rigidum*, colour?; Java. *D. ruckeri*, yellow; Philippines. *D. rugosum*, pale yellow; Java. *D. salaccense*, yellow; Java. *D. scopa*, whitish; Philippines. *D. secundum*, rose purple; Malacca. *D. pallidum*, pale purple; Sumatra. *D. taurinum*, yellow and purple; Philippines. *D. teres*, white and orange; Singapore. *D. undulatum*, flowers in long spikes, yellow and brown; common amid mangroves, Malaysia to Australia. *D. vaginatum*, straw-coloured and purple; Singapore. *D. veitchianum*, yellow, white, and crimson; Java. *D. zollingerianum*, Java and Singapore; var. *album*, Singapore.

*Dendrochilum abbreviatum*, green and white; Java. *D. filiforme*, green and yellow; Luzon. *D. glumaceum*, pale green; Manila. *D. latifolium*, green; Manila. *D. longifolium*, greenish-white; Singapore.

*Aporum indivisum*, colour?; Java. *A. leonis*, red-brown; Singapore. *A. sinuatum*, yellow; Singapore. *A. sarcostomum*, colour?; Malacca.

*Bolbophyllum adenopetalum*, yellow; Singapore. *B. beccari*, white; Borneo. *B. calamarium*, yellow; Singapore. *B. limbatum*, purple; Singapore. *B. lobbii*, yellow-brown; Java. *B. pileatum*, yellow; Singapore. *B. purpureum*, purple; Java. *B. sp.*, yellow; common in Malay Peninsula. *B. vaginatum*, brown; Singapore.

*Cirrhopetalum antenniferum*, brown; Philippines. *C. auratum*, yellow and crimson; Manila. *C. blumei*, yellow and red; Java. *C. candelabrum*, straw-coloured and purple; Manila. *C. capitatum*

yellow and orange; Java. *C. compressum*, purple and yellow; Java. *C. cumingii*, ruby-coloured; Philippines. *C. elongatum*, red and yellow; Java. *C. maxillare*, brown and yellow; Philippines. *C. medusæ*, pink spotted; Singapore; Borneo. *C. nutans*, pale straw-coloured; Manila. *C. pahudii*, colour?; Java. *C. stramineum*; Sumatra. *C. thouarsii*, colour?; Java. *C. vaginatum*, pale yellow; Singapore. Besides other undescribed species in cultivation.

*Eria armeniaca*, orange; Philippines. *E. bractescens*, stone colour; Singapore. *E. cochleata*, white and crimson; Luzon. *E. convalarioides*, white; Keddah. *E. denticulata*, white; Singapore. *E. dillwynii*, white; Philippines. *E. flava*, yellow; Java. *E. fusco-viride*, brown and green; Singapore. *E. leucostachys*, white; Borneo. *E. mucronata*, white and pink; Singapore. *E. multiflora*, white; Malacca. *E. nutans*, white and yellow; Singapore. *E. obesa*, white; Singapore. *E. ovata*, crimson and white; Singapore. *E. pannea*, green and yellow; Singapore. *E. polyura*, white; Manila. *E. stellata*, yellowish; Java. *E. velutina*, yellow; Singapore. *E. vestita*, red-brown; Malacca.

*Cælogyne*:—Pseudo-bulbous Orchids with flowers large and membranaceous, pollen masses four in number, waxy, united by a granular substance; stigma deeply hollowed out, two-lipped. *C. asperata*, Lindley, India (= *C. lowii*, Paxton), white; Borneo. *C. cinnamonea*, brown; Java. *C. corrugata*, yellowish; Perak. *C. cumingii*, white, crimson, and yellow; Singapore. *C. longifolia*, colour?; Mount Salak, Malacca. *C. pandurata*, green and black; Borneo. *C. plantaginea*, pale yellow; Singapore. *C. speciosa*, brown; Java. *C. testacea*, brown; Singapore. *C. trinervis*, white and yellow; Singapore.

*Pholidota clypeata*, green and yellow; Borneo. *P. conchoidea* yellow; Luzon. *P. imbricata*, yellowish; Malay Peninsula.

*Spathoglottis aurea*, yellow; Malacca. *S. plicata*, colour?; Singapore. *S. tomentosa*, crimson; Mindanao, Philippines.

*Cymbidium aloifolium*, purple and yellow; Malaysia. *C. atropurpureum*, dark purple and yellow; Borneo. *C. brevilabre*, green,

red and yellow ; Singapore. *C. pubescens*, purple and yellow ; Singapore. *C. sanguineum*, red ; Java.

*Arundina densa*, rose and violet ; Singapore. *A. speciosa*, colour ? ; Java.

*Collabium nebulosum*, dark purple and yellow ; Java.

*Plocoglottis acuminata*, colour ? ; Singapore. *P. javanica*, colour ? ; Perak ; Johore.

*Phaius callosus*, brown and white ; Java. *P. grandifolius*, brown, red, white ; Perak ; Selangore.

*Thrixspermum unguiculatum*, rose pink ; Luzon, Philippines. Plant like *Phalænopsis rosea* ; flowers much inferior, often imposed upon purchasers for *Phalænopsis*.

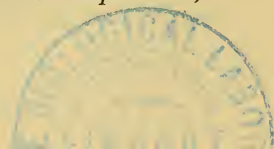
*Eulophia macrostachya*, yellow and green ; Singapore. *E. squalida* pale green ; Manila.

*Vanda batemanni*, crimson and yellow ; Moluccas. *V. fuscovioides*, brown ; Java. *V. gigantea*, white, Perak. *V. hookeri*, colour ? ; Labuan, Borneo ; Kinta, Perak. *V. helvola*, red ; Java. *V. insignis*, lilac and brown ; Java. *V. lamellosa*, pale yellow ; Luzon. *V. limbata*, brown and lilac ; Java. *V. lissochilus*, colour ? ; Luzon. *V. suavis*, white and purple ; Java. *V. tricolor*, yellow and rose ; Java. *V. violacea*, white and violet ; Luzon.

*Renanthera arachnites*, brown and purple ; Java and Singapore. *R. lowii* (*Vanda*, Lindley) yellow and brown ; Borneo. *R. matutina*, brownish ; Java.

*Saccolabium bifidum*, pink and yellow ; Luzon. *S. blumei*, violet and white ; Malaysia and Philippines. *S. compressum*, crimson and white ; Luzon. *S. densifolium*, rose ; Manila. *S. harrisonii*, colour ? ; Timor. *S. hendersonianum*, colour ? ; Malaysia. *S. macrostachyum*, rose ; Philippines. *S. miniatum*, vermilion ; Java. *S. pallidum*, pink ; Manila.

*Bromheadia finlaysonianum*, colour ? ; Singapore. *B. palustris*, white ; Singapore.



*Sarcanthus croceus*, yellow ; Luzon. *S. teretifolius*, colour ? ; Singapore.

*Ceocclades falcata*, white ; Malaysia.

*Arides huttoni*, white ; Borneo. This genus is named from *aer* the air, because the plants possess the power of living almost entirely upon matter which they absorb from the atmosphere. The flowers usually are very fragrant and amongst the largest orchids known. *A. teniale*, growing on branches, has long flat roots hanging down like the joints of a tape-worm ; hence the name. *A. quinquevulnerum*, pink, with five red blotches on each flower, which the Spaniards in the Philippines likened to the wounds of our Lord ; it is cultivated in Singapore. *A. suaveolens*, colour ? ; Java. *A. suavissimum*, white, lilac, orange ; Malacca. *A. virens*, purple and white ; Java. *A. superbum*, purple and white.

*Thelasis capitata*, Bl., colour ? ; Java. *T. carinata*, Bl., colour ? ; Java.

*Acanthophippium javanicum*, crimson, rose ; Java.

*Calanthe abbreviata*, colour ? ; Java. *C. angustifolia*, colour ? ; Java ; Gunong Hijau, Perak. *C. curculigoides*, orange ; Malacca. *C. emarginata*, violet and orange ; Java. *C. furcata*, white ; Luzon. *C. parviflora*, colour ? ; Java. *C. pulchra*, orange ; Java. *C. speciosa*, orange ; Java. *C. veitchii*, purple and rose ; Borneo. *C. veratrifolia*, white ; Java. *C. vestita*, white and crimson ; Perak ; Malacca ; Singapore ; Borneo.

*Grammatophyllum fastuosum*, brown and yellow ; Malacca. *G. multiflorum*, green and brown ; Luzon. *G. scriptum*, colour ? ; Amboyna. *G. speciosum*, yellow and purple ; plant ten feet high ; flower-stem six feet long ; flowers six inches across ; called the Queen of Orchids ; Java. *G. tigrinum*, brown-spotted ; Luzon.

*Leopardanthus scandens*, colour ? ; Java ; Singapore.

*Phalænopsis amabilis*, white and yellow ; Manila ; Borneo. *P. grandiflora*, white and yellow ; Java ; Borneo. *P. cornucervi*,

colour?; Java and Malay Peninsula. *P. lowii*, pink and white; Malay Peninsula. *P. luddemanniana*, colour?; Philippines. *P. rosea*, pink and white; Luzon. *P. schilleriana*, purple; Philippines. *P. sumatrana*, colour?; Sumatra. *P. violacea*, violet; Kinta, Perak.

*Goodyera procera*, cinnamon; Singapore. *G. rubicunda*, cinnamon; Malaysia.

*Anectochilus dawsonianus*, colour?; Malacca. *A. lowii*, colour?; Borneo. *A. setaceus*; Ceylon; Malaysia. *A. xanthophyllus*; Gunong Pulai, Johore. (All inconspicuous flowers).

*Cypripedium barbatum*, rose and brown; Malacca; Penang; Keddah. *C. concolor*, yellowish; Perak. *C. hirtissimum*, purple and brown; Java. *C. hookeri*, purple and yellow; Java. *C. lawrencianum*, colour?; Borneo. *C. lowii*, green, purple, and yellow; Borneo. *C. purpuratum*, purple; Hongkong. *C. stonei*, purple; Borneo.

*Physurus* sp.; Perak.

WATER PLANTS.—Reference has already been made to *Nelumbium speciosum*, and the lotus (*Nymphaea*) which are seen in all still waters. In other respects the ponds and running streams are infested with the usual water plants. Thus the aquatic dicotyledons principally belong to the HALORAGEÆ, with some representatives amongst the ONAGRARIÆ, LENTIBULARIÆ, &c. A common floating or creeping herb with alternate oval leaves and yellowish flowers is seen in all swamps and brooks. This is *Jussiaea repens* common in most tropical countries including Australia, as far south even as Victoria and South Australia. There are curious floats of cellular tissue attached to the submerged nodes of the stems. The HALORAGEÆ are a nearly allied order including the Water-chestnuts (*Trapa*), important food-plants in north-west India and China, the Mill-foils (*Myriophyllum*), the Horn-worts (*Ceratophyllum*), and the Mare's-tail (*Hippuris*), with that universally diffused small smooth water-weed or star-wort



seen equally in the ditches of Britain, America, Australia and Malaysia. This is *Callitriche verna*, worth more than a passing examination for its curious fruits and monœcious flowers. It is doubtful whether *Myriophyllum* occurs in Malaysia; if it does, *M. indicum*, Willd., is the species. The *Trapa* can be recognised by the seeds, but the lower leaves are finely multifid like *Myriophyllum*, while the upper or floating ones are deltoid, smooth and disposed in a rosulate manner. The white kernel inside the hardened calyx-lobes tastes like a chestnut and is nourishing. It is largely used in France, Italy, India, Thibet, China and Japan. The Japanese use the roots also, though the taste is not agreeable. In *Hippuris* the flower is reduced to a calyx of the smallest size, no petals and but one stamen and one carpel. The stem is curiously formed of cellular tissue radiating from the centre with large air-cavities between. The centre is a cylinder of fine woody tubes, cellular tissue and spiral vessels, which led Prof. Link to regard them as endogens. The LENTIBULARIÆ are represented by probably half-a-dozen species of *Utricularia*, the commonest of which are *U. stellaris*, *U. exoleta*, *U. bifida* and *U. reticulata*. In all these the stems are floating with the leaves submerged, divided into capillary segments with minute bladders attached, hence the vernacular name Bladder-worts. Several small Indian species, growing on the ground, are leafless at the time of flowering. *U. reticulata*, a species with large purple flowers, is common in rice-fields. It is variable in its habit and the size of its flowers. The larger forms of it are twining; the smaller rigid and erect.

Of endogenous water-plants there is of course the Duck-weed (*Lemna oligorrhiza*) a rather larger species than that of Europe. *Potamogeton tenuicaulis* with a few linear submerged leaves takes the place of the British *P. natans*. The Malaysian Frog-bit is *Enhalis kœnigii* with linear leaves and edible fruits found in fresh and brackish waters. Its fibres are capable of being woven.\*

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\* On the authority of Lindley (Veg. King. p. 141), who quotes Agardh, Aphorismi Botanici, a reference which I am unable to verify. I know of no economical purpose to which the fibre is applied in the East, but I may add my own observation that the plant is rich in fibre of a fine and tenacious quality.

*Pistia stratiotes* is found in all the freshwater streams and lakes of Malaysia and the Philippines, covering the surface with plants that look like small lettuces. It floats in rafts bound together by runners, with roots hanging free in the water or touching the muddy bottom. It is very acrid, but in the Philippines is boiled and used as food for pigs. *Blyxa roxburghii* is a submerged herb with long, grass-like, acute and entire leaves, without laminae, tufted, with the flowering peduncles at the bottom of the water. This is spread in the fresh waters of tropical Asia along with *Vallisneria spiralis* from which it differs in the shape of the leaf and flower. Another submerged herb, but with the radical leaves and peduncles in tufts together on the muddy bottom, and with the leaves bearing a broad lamina, is *Ottelia alismoides*, a species found in every stagnant pool throughout Malaysia and the East Indies. *Hydrilla verticillata* is also common and widely dispersed in still and running waters, not only in the tropics, but the temperate regions of Europe and Asia. The stems are leafy throughout, with short verticillate leaves; it is much branched and floats under the water in large masses, where it has proved fatal to many a swimmer. Finally *Monochoria vaginalis* is an aquatic herb common in the rice-fields and ditches, with radical, petiolate, cordate leaves, and racemes (apparently springing from the side of a petiole) of several rather large bright blue flowers. It is employed in Indian pharmacy in liver complaints and stomach diseases. Rubbed down in butter and eaten, it is thought to remove redness of the eyes; powdered and mixed with sugar it is administered in asthma; and when chewed is said to relieve toothache; brayed with milk it is given in fever; and finally, when young is eaten as a vegetable. It is very abundant in ditches around Thaiping, Perak. The other members of the pondweed families including the Grass-wrack, the Eel-grass, Duckweed, Water-plantain, Cat-tails, Arrow-heads and Flowering-rushes, have nothing special about them. *Azolla rubra* is a common minute aquatic cryptogam which completely covers the surface of the water with a purplish-green crust.

*Crinum asiaticum*, a bulbous plant with large mostly white flowers in a terminal umbel, is seen on the water-sides of most tropical streams, and by the sea-side in Asia, Africa and Australia. The same may be said of an equally showy plant closely resembling it, named *Eurycles amboinensis*. Both belong to the order AMARYLLIDÆ.

Though the cryptogams will be dealt with subsequently, mention may here be made of an aquatic fern, *Ceratopteris thalictroides*, with distinct sterile and fertile fronds. The genus is limited to the single species which is widely distributed over the tropical regions of the whole world. The spores of this species are interesting to the microscopist as they are marked with curious concentric rings.

*Ataccia cristata* is a peculiar-looking plant in the jungle, of which a separate order, the TACCACEÆ, has been made. The flowers are arranged in umbels at the end of a scape of green and dark purple, with numerous long filaments of sterile pedicels. In the South Seas a kindred plant is cultivated for the starch of the root. The root is red, round, and about three inches in diameter, bitter and acrid, but losing some of this by culture. The raw root is peeled, rasped and washed frequently, when a starch is separated and again washed until the water has no longer an acrid taste. The bitter juice is probably violently poisonous. The meal makes a tasteful, nourishing, gelatinous bread, consisting principally of bassorin. The starch consists of circular or polyhedral particles with few and not very distinct rings. In Banda it is preferred to sago bread, and generally in the Moluccas is used for cakes and confectionery. The name *Tacca* is said to be derived from the Malay language, while Royle\* says that it is the *Tacca-youy* of some navigators. The tubers are eaten in China, Cochin China and Travancore. The leaf-stalks and scape, as well as the roots, are boiled for a long time to destroy the acidity, but even then some vegetable acid is required to make it palatable.

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\* "Illustrations of the Botany of the Himalayan Mountains," p. 378.

The Malay plant is not the same as a *Tacca* similarly used in the Pacific Islands, of which Mr. Nuttall\* has pointed out the differences. Ellis in his "Polynesian Researches"† says that the "*Pia* or Arrowroot, *Chailia Tacca*, grows on the high sandy banks near the sea or on the sides of the lower mountains." The starch is obtained by rasping with a board on which coarse coir twine is wound. The pulp is washed with *sea-water* and strained, the sediment formed into balls, dried in the sun for 12 or 24 hours, then broken and reduced to powder, which is left in the sun to dry. This detail is given as one of many points of contact, domestic as well as linguistic, between the Malay and Polynesian races.

CRYPTOGAMS.—In such a moist and warm climate, with dense shady forests, ferns, mosses, lichens and fungi must be abundant. Every rock and every foot of forest ground, the dead timber especially, and the roots and stems of the tall trees are, so to speak, muffled and enshrouded with this kind of vegetation. It is marvellous sometimes to see how deeply the ground is covered with this growth. To step aside off the narrow beaten tracks into the tangled thicket of branches and dead wood causes one frequently to disappear into as much as five, ten, and even fifteen feet of a mass of ferns, mosses, vines, rattans and decaying vegetation. Or when one attempts to peer through the almost vaulted roof of branches with which the forest glades are so thickly covered, one sees a rich and varied aerial growth which quite impedes any extensive view. Bird's-nest Ferns (*Asplenium nidus*) and Stag's-horn Ferns (*Platyserium biforme*) beautifully ornament the lofty branches of the stateliest trees, causing an astounding mass of vegetation to hang as it were in mid-air. The Bird's-nest Fern standing out like a feathered coronet, the Stag's-horn dependent as a graceful fringe, while the giant Polypody (*Polypodium heracleum*)

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\* "American Journal of Pharmacy," IX. p. 306.

† "Polynesian Researches during a residence of nearly eight years in the Society and Sandwich Islands." By the Rev. William Ellis, I., p. 361 (4 vols. 12mo. London, 1839).

sends stout and tall fronds eight and ten feet into the air. The large species moreover of tree-ferns, and such giants as *Angiopteris evecta*, vie with the Palm-trees in the spread of their graceful fronds, while the epiphytes of the smaller kind make hoary tufts and clothing for almost every tree. The little *Drymoglossum piloselloides* is seen on every tree, outside the forest as well as in it, and many other minute forms, particularly *Polypodium*, *Niphobolus* and *Vittaria*.

I do not propose to enter into any detail about the genera and species which is obviously beyond the scope of this essay, but I give a list from the "Journal of Botany"\* of the ferns found in Perak by Father Scortechini and myself and described by Colonel Beddome, which I may say includes nearly all that is known up to the present time of the cryptogamic flora.†

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\* Journ. of Botany, Nov. 1887, XXV. p. 321, pl. 278.

† I take this opportunity of explaining a circumstance under which the ferns described by Colonel Beddome were collected. I arrived in Perak in November, 1883, having previously travelled through Java, part of Sumatra and much of the Malay Peninsula. In all these journeys I had made extensive collections of plants, some of which I exchanged with Mr. Nicholas Cantley, the Government Botanist, Singapore. Father Scortechini arrived in Perak on March 1st, 1884, and we explored and collected together for about six months, under the auspices of the Perak Government and at its expense. The Rev. Mr. Scortechini devoted himself exclusively to botany, and so on his arrival I handed over to him all my collections of plants from the Straits Settlements and elsewhere, with the understanding that I was to get a complete set of the ferns from his collections before he went to Kew. The melancholy and unexpected death of the rev. gentleman at Calcutta prevented this arrangement being carried out, and I mention it only for the purpose of stating that I am the authority for many of the habitats given in the ensuing list. They may have been found subsequently in other places by Father Scortechini, but I give the habitats that I know. Perhaps it may be permitted to me here to add the inestimable loss science has sustained by the premature death of so learned, painstaking, and experienced a botanist. Personally amiable, generous, and self-sacrificing, he was an invaluable companion to me in my explorations. He was indeed an instance of the *ἄνθρωπον πάντα καλῶς ποιῆν*, whose loss was equally great to friendship and to fame.



## A LIST OF THE FERNS OF THE MALAY PENINSULA.

The species marked \* have not been previously recorded from the Peninsula.

*Gleichenia dicarpa*, Br., var. *vulcanica*, Bl., on all the roadsides and throughout the jungles of the Malay Peninsula and Indian Archipelago. \**G. flagellaris*, Spr., very common on roadsides near Singapore. *G. norrisii*, Mett., Salama River, Perak, near Malacca. *G. dichotoma*, Willd., very wide-spread and common, extending to Australia.

*Cyathea brunonis*, Wall., mountain ranges to 3,000 feet.

\**Alsophila obscura*, Scort., not common, but I believe this species was found in the interior beyond the Kinta River, Perak; *A. glabra*, Hook., Maxwell's Hill, Perak; *A. latebrosa*, Hook., all through the Peninsula occasionally; *A. latebrosa*, var. with very broad segments, Arang Para?; *A. glauca*, J. Sm., in the gullies on the lower slopes of Gunong Bubu; *A. kingi*, Clarke; *A. commutata*, Mett.; \**A. trichodesma*, Scort., this specimen was, I believe, found on the Upper Salama River, on the Keddah side of the shore; its nearest ally is *A. andersoni*, Scott, Sikkim.

*Matonia pectinata*, Br. This plant is stated by Wallace to be found only on the summit of Mount Ophir, which he also believed to be the highest mountain in the Malay Peninsula, this being the general impression at the time of his visit (1861. See Wallace, "Malay Peninsula," p. 31). Found also on the upper slopes of Gunong Bubu when first explored, and then generally at a height of about 4,000 feet throughout the Peninsula. It occurs also in Java.

\**Dicksonia barometz*, Link., in the deepest mountain gullies throughout Perak; *D. (Dennstædtia) ampla*, Baker.

*Lecanopteris carnososa*, Bl.

*Hymenophyllum polyanthos*, Sw., var. *blumeanum*, Spr., Arang Para on stems of tree-ferns; *H. javanicum*, Spr., var. *badium*, Hooker and Greville; *H. javanicum*, Spr.; *H. smithii*, Hook.; *H. neesii*, Hook.; \**H. aculeatum*, V. d. B.

\**Trichomanes neilgheriense*, Bedd., not uncommon in northern Perak; *T. parvulum*, Poir., this wide-spread species is common everywhere; *T. pyxidiferum*, another very common species widely spread over all tropical regions; *T. digitatum*, Sw.; *T. pallidum*, Bl.; *T. bipunctatum*, Poir.; *T. auriculatum*, Bl.; *T. javanicum*, Bl.; *T. rigidum*, Sw., very common and widely spread; *T. maximum*, Bl.; *T. pluma*, Hk., on the summit of Gunong Bubu above 5,000 feet.

*Davallia (Humata) heterophylla*, Sm.; *D. angustata*, Wall.; *D. pedata*, Wall., common in Perak and widely spread; *D. (Prosaptia) emersoni*, Pres.; *D. contigua*, Sw.; *D. (Leucostegia) pulchra*, Dru.; *D. hymenophylloides*, Bl.; *D. nodosa*, Presl.; *D. solida*, Sw.; *D. elegans*, Sw.; *D. epiphylla*, Bl.; *D. divaricata*, Bl.; *D. griffithiana*, Hk.; *D. bullata*, Wall.; *D. (Microlepia) pinnata*, Cav.; \**D. moluccana*, Bl.; *D. speluncae*, Baker, very common and widely spread; *D. (Stenoloma) tenuifolia*, Sw.

*Lindsaya cultrata*, Sw.; *L. repens*, Thw., the jungle, Arang Para; *L. scandens*, Hk.; *L. orbiculata*, Lam.; \**L. borneensis*, Hk.; *L. lancea*, L.; *L. rigida*, J. Sm.; *L. divergens*, Wall.; *L. lanuginosa*, Wall.; *L. lobata*, Poir.

*Pteris longifolia*, L., on rocks and trees everywhere in the jungle, Malay Peninsula; *P. cretica*, L., equally common with preceding, on buildings, rocks, &c., Malaysia generally; *P. semipinnata*, L.; *P. patens*, Hook.; *P. quadriaurita*, Wall., the white variegated variety, jungle, Perak River; Kuala Kangsa: *P. aquilina*, L., waste sterile savannahs, Malaysia generally; *P. aquilina*, var. *esculenta*, Forst., waste sterile savannahs as above; *P. (Doryopteris) ludens*, Wall.; *P. (Litobrochia) incisa*, Thunb., Maxwell's Hill, Thaiping, Perak, about 3,000 feet; *P. marginata*, Bory.

*Ceratopteris thalictroides*, Brong., Salama River, Perak River, and common in all Malayan streams.

*Lomaria (Plagiogyria) pycnophylla*, Kze., Arang Para on lower slopes.

*Blechnum orientale*, L., common in all Malayan jungles; *B. findlaysonianum*, Wall.

*Asplenium (Thamnopteris) nidus*. L., on trees in all Malayan forests; \* *A. scortechinii*, Bedd., Caulfield's Hill, Maxwell's Hill, above 3000 feet. The following *Asplenium* are generally diffused through the mountain ranges:—*A. amboinense*, Willd.; \**A. squamulatum*, Bl.; *A. normale*, Don; *A. subavenium*, Hk.; *A. longissimum*, Bl.; *A. tenerum*, Forst.; \**A. borneense*, Hook.; *A. hirtum*, Kaulf.; *A. falcatum*, Lam.; *A. macrophyllum*, Sw.; *A. caudatum*, Forst.; *A. cuneatum*, Lam.; *A. nitidum*, Sw.; *A. belangeri*, Kze.; *A. (Anisogonium) cordifolium*, Mett.; *A. lineolatum*, Mett.; *A. esculentum*, Presl.

*Diplazium subserratum*, Bl.; *D. porrectum*, Wall.; *D. pallidum*, Bl.; *D. bantamense*, Bl.; *D. sylvaticum*, Presl.; *D. tomentosum*, Hk.; *D. speciosum*, Mett.; *D. sorzogonense*, Presl.; *D. asperum*, Bl.; *D. polypodioides*, Mett.

*Didymochlæna lunulata*, Desv., in all the jungles on the mountain sides up to 3,000 feet; *D. polycarpa*, Baker.

*Aspidium (Polystichum) auriculatum*, L., var. *marginatum*, Wall.; do. var. *cæspitosum*. Wall.; *A. aculeatum*, Sw., var. *biaristatum*, Bl., occasionally met with in the undergrowth in all Malaysia; *A. (Pleocnemia) leuzeanum*, Hook.; *A. membranaceum*, Hook.; *A. singaporianum*, Wall., occasionally met with through the whole Peninsula; *A. melanocaulon*, Bl., fragment only; *A. vastum*, Bl.; *A. subtriphylum*, Wall.; \**A. pachyphyllum*, Kze.; *A. variolosum*, Wall.; *A. cicutarium*, Sw.?

*Nephrodium (Lastrea) gracilescens*, Bl.; \*do. var. *glanduligera*, Kze.; *N. calcaratum*, Bl., var. *sericea*, J. Sm.; *N. crassifolium*,

Bl. ; do. var. *mottleyanum*, Hk. ; *N. symmaticum*, Hk. ; \**N. dayi*, Bedd. ; *N. filix-mas*, Rich., var. *elongata*, Hook. ; *N. sparsa*, Don ; *N. blumei*, Hook. ; *N. boryanum*, Baker ; *N. unitum*, L. ; \**N. eminens*, Baker ; *N. pennigerum*, Bl., var. ; *N. molle*, Desv., extremely common everywhere in Malaysia ; *N. crinipes*, Hk.

\**Nephrolepis exaltata*, L. ; *N. volubilis*, J. Sm. ; *N. biserrata*, Schott ; \**N. acuminata*, Hout.

*Oleandra neriiiformis*, Cav. ; *O. musafolia*, Kze.

*Polypodium (Phegopteris) punctatum*, Thunb. ; \**P. laserpitii-folium*, Scort. ; *P. (Dictyopteris) difforme*, Bl. ; *P. subvenosum*, Baker ; \**P. hirtellum*, Bl. ; \**P. cornigerum*, Baker ; *P. cucullatum*, Nees ; \**P. triangulare*, Scort., on the very highest summits of the mountain ranges about Thaiping, where it grows in tufts on withered branches of stunted trees ; *P. khasyanum*, Hook. ; *P. fuscatum*, Bl. ; *P. decorum*, Brack. ; *P. obliquatum*, Bl. ; *P. subfalcatum*, Bl. ; \**P. papillosum*, Bl. ; \**P. tenuisectum*, Bl.

*Goniophlebium subauriculatum*, Bl. ; *G. verrucosum*, Wall. ; \**G. korthalsii*, Mett.

*Niphobolus adnascens*, Sw. ; *N. acrostichoides*, Forst. ; *N. stigmatosum*, Sw. ; *N. nummularifolium*, Mett. ; *N. fissum*, Bl. ; *N. penangianum*, Hk.

*Pleopeltis accedens*, Bl. ; *P. wrayi*, Baker ; *P. stenophyllum*, Bl. ; *P. longifolium*, Mett., on rocks 3,000 feet ; *P. angustatum*, Sw. ; *P. superficiale*, Bl. ; do. var. ; *P. sinuosum*, Wall. ; \**P. rupestre*, Bl. ; \**P. platyphyllum*, Sw. ; *P. irioides*, Lam., near mangrove swamps in all Malaysia ; *P. musafolium*, Bl. ; *P. sp.* near *membranaceum*, but with the rachis shining black ; *P. hastatum*, Thunb. ; *P. incurvatum*, Bl. ; *P. phymatodes*, L., near sea coast, Malaysia ; *P. nigrescens*, Bl. ; *P. longissimum*, Bl. ; *P. palmatum*, Bl.

*Dipteris horsfieldii*, R. Br., generally above 3,000 feet, but at Singapore extending to sea-level ; *D. bifurcatum*, Baker.

\**Drynaria heracleum*, Kze., above 3,000 feet, Maxwell's Hill, Perak; *D. linnæi*, Bory; *D. rigidulum*, Sw.

\**Monogramme paradoxa*, Fée.

*Gymnogramme (Stegnogramme) aspidioides*, Hk., var.; *G. fraxinea*, Don; *G. wallichii*, Hk.; *G. alismæfolia*, Hk.; *G. lanceolata*, Hk.; *G. involuta*, Hook; *G. feei*, Hk.; \**G. hamiltoniana*, Hk.

*Meniscium triphyllum*, Sw.; *M. salicifolium*, Wall.; *M. cuspidatum*, Bl.

*Antrophyum nanum*, Fée; *A. reticulatum*, Kaulf., Maxwell's Hill, on granite rocks below bungalow, rare; *A. semicostatatum*, Bl.; *A. latifolium*, Bl.

*Vittaria elongata*, Sw., Maxwell's Hill, on dead logs above bungalow; *V. falcata*, Kze., open forests at all elevations, on trees; \**V. sulcata*, Kuhn, as above, but not common; *V. lineata*, Sw., throughout Malaysia; *V. scolopendrina*, Presl., as above.

*Tenitis blechnoides*, Sw., Arang Para.

*Drymoglossum piloselloides*, Presl., everywhere in Malaysia. A small epiphyte on the stems of trees; leaves of two forms; the sterile, elliptical; the fertile, contracted, linear.

*Acrostichum (Elaphoglossum) conforme*, Sw.; *A. (Stenochlaena) palustre*, L.; *A. sorbifolium*, L.; *A. (Polybotrya) appendiculatum*, Willd.; *A. (Gymnopteris) minus*, Mett.; *A. spicatum*, L.; *A. contaminans*, Wall.; *A. variabile*, Hk.; *A. subrepandum*, Hook.; *A. aureum*, L., in all mangrove swamps, where its fronds attain 10 to 12 feet; the young leaves are subject to great variation in colour, being often of a brilliant red, the older leaves coriaceous and shining green, contrasting well with the rich brown sori of the back: *A. (Photinopteris) rigidum*, Wall., common everywhere on the lower grounds; *A. drynarioides*, Hook., as above.

*Platynerium biforme*, Bl.; on trees at lower levels.



*Schizæa malaccana*, Baker; *S. dichotoma*, Sw., this fern sometimes takes the place of grass on savannahs, Perak; \**S. digitata*, Sw.

*Lygodium dichotomum*, Sw., widely spread in all jungles; *L. flexuosum*, Sw., particularly abundant in open marshy plains about Thaiping, Perak; *L. microphyllum*, Br., as above and Singapore.

*Angiopteris evecta*, Hoffm., not very common.

\**Kaulfussia æsculifolia*, Bl. I have seen this only in one place, on rocks, Maxwell's Hill, above 2,000 feet.

*Ophioglossum reticulatum*, L., moist, shady jungles near Kuala Kangsa; *O. pendulum*, L., as above.

*Helminthostachys zeylanica*, Hk., on the sea coast.

CULTIVATED PLANTS.—The cultivated plants in every country include many which do not belong to the indigenous flora; in fact, when we trace the origin of most of the useful fruits, flowers, and other vegetable products, it is astonishing how widely diverse are the sources from which they come. There is not an extensive list in Malaysia in comparison with other countries. Nevertheless it is of sufficient length to render necessary some condensation in this essay. For convenience I shall consider—(1) the fruits; (2) vegetables; (3) plants useful in manufactures, with some remarks on the ornamental trees and shrubs.

FRUITS—In Malay Buah.—Several common tropical fruits need not be more than named here, such as the Sweet Sop, Sour Sop, Bullock's Heart, and Custard Apple, which are, though the fact has been disputed, undoubtedly of American origin. The local names, besides Cherimolia or Chirimoya, are applied so as to cause confusion; but generally the Sweet Sop and Sugar Apple is applied to *Anona squamosa*, L.; Sour Sop, *A. muricata*, L.; Bullock's Heart, *A. reticulata*, L.; and Chirimoya, *A. cherimolia*, Lam. The first two are not much cultivated, though the Sour Sop is used for ices, for which it is much esteemed, particularly

in Java. The Custard Apple is called *Seri kaya*. Bullock's Heart is well cultivated in the gardens round Malacca, and there it is obtained at its best. In Java it is a very poor worthless fruit.

Oranges and Lemons, that is, all the different varieties of Citrons, Lemons, Oranges, Shaddocks, &c., are well represented in the Malay Peninsula, though the climate is not favourable to the majority of the species. China is generally regarded as the indigenous home of the orange tribe, for which the Malay language has, however, many names, probably indicating an ancient cultivation. The following are quoted:—*Limau-manis*, *L. kusturi*, *L. jamboa*, *L. japon*, *L. nipis*, *L. susu*, *L. asam* (lemon, lime), *L. jeruk* (citron), Malay, Sundanese, and Javanese. In Borneo, in the wild countries of the Dusuns, near Gaya, I obtained very good oranges and lemons. Probably the orange most consumed in Malaysia is the Shaddock, or Pompelmouse (French), *Linau gadang* in Malay, *Citrus decumana*, Willd., the Poor Man's Orange of Europeans, or Pomeloe (from the Dutch Pompelmoes). It is said that the best of these come from Amoy in China; but they are equalled, if not surpassed, by those produced in Labuan, Borneo. For this the colony owes a debt to Sir Hugh Low, who was for over 20 years a resident on that island. During this time he gave unceasing care to the introduction and cultivation of tropical fruits. His garden and indeed every cultivated plot in the island give evidence of his skill and care. The large extent of the gardens round Government House might be likened to those of the Hesperides in the season of this magnificent fruit. It is of the richest kind and with a flavour of the finest quality. The original country of the fruit is not known, but the number of varieties in Malaysia indicates an ancient cultivation.

Roxburgh says, "that the species was brought to Calcutta from Java" (Roxburgh, "Flora Indica," edit. 1832, III., p. 393), and Rumphius ("Hortus amboinensis," II. p. 98) believed it to be a native of southern China. Neither he nor modern botanists saw it wild in the Malay Archipelago (Miquel, "Flora Indo-Batava,"

I. pt. 2, p. 526). In China the species has a simple name, *Yu*; but its written character (Bretschneider, "Study and Value," etc.), appears too complicated for a truly indigenous plant. According to Loureiro the tree is common in China and Cochin-China, but this does not imply that it is wild (Loureiro, "Fl. Cochin," II. p. 572). For another species of the genus he says that it is cultivated and non-cultivated (p. 569). "It is in the islands to the east of the Malay Archipelago that the clearest indications of a wild existence are found" (De Candolle, "Origin of Cultivated Plants," p. 178).

The rind of this species is much esteemed for bitters. It is said that Shaddock was the name of the captain who introduced the fruit to the West Indies. Pimpelnose is another name in English, and Pompoleon one in French. Some Malays for an unknown reason call this the Bali Lemon (Jeruk Bali, also Majang). In Javanese it is Limau kasumba. Other Malay names are Jeruk dalima, J. jamblang, J. gedogan. In Tagalo (Philippines), Dalandan, Dayap, and Kalamondin; Kahil, Visayan, besides Limon generally. Lemon susu is *Citrus medica*, L., probably indigenous to the Malay Peninsula, or at any rate introduced in ancient times into Java, Amboyna, and the Peninsula.\* The orange in all Malaysia is much inferior to the varieties cultivated in southern Europe; not the only instance of naturalised fruits becoming much superior to the best productions in their native country.

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\* In Filet's "Plantkundig Woordenboek voor Nederl. Indie," and in Bisschop Grevelink's "Planten van Nederl. Indie, bruikbaar voor handel, nijverheid en geneeskunde" (Amsterdam 1883), a great number of Malay terms are given for different species of *AURANTIACEÆ*; but the references are too lengthy for quotation here. Filet gives a list of 35 names, but some of them are Sundanese and Javanese. The Dutch orthography makes them appear as if differing more from the common Malay terms than they are in pronunciation. Thus, jeruk, which according to these authorities is the common Malay term for these fruits generally, is spelled djeroek or djeroeh, for the final *k* in Java is not sounded as in Perak Malay. The Philippine list of names might be much extended. The name jeruk is found in all the languages west of Celebes, as well as the Portuguese word limau.

The other members of the orange family in Malaysia deserving of some notice are, first, *Murraya exotica*, L. (Malay, Kamuning japan), which is found all over south Asia, Java, Timor, and the Moluccas; valued for its white fragrant flowers and small succulent fruits. The tree, however, and another species, *M. sumatrana*, Roxb., are valued on account of the wood, though seldom growing high, and the stems rarely exceeding a diameter of eight inches. The wood is pale yellow, grained with black, in quality much resembling box, and even finer, with a closer fibre, excellent for turners' work. The best grows in Menado, Celebes. Malays attach great value to this wood to make scabbards and ornamental boxes.

*Cookia punctata* is another member of the orange family, the fruit of which is much esteemed. It is a small orange, growing in bunches, extensively used in preserves by the Chinese, who call it Wampee. It is the Wilde-lansen of Valentyn, and Kibecha puti of the Malays, or Ki-bejek-bodas of the Sundanese.

*Feronia elephantum*, Corr., the Elephant Tree of India has a fruit about the size of an apple, when ripe green outside and yellow within, one-celled, with numerous seeds immersed in a fleshy edible pulp contained in a hard rough woody rind. The pulp is valued for preserves, besides being esteemed for its medicinal qualities. Altogether the tree is very useful. Lac is obtained from it, and it yields a gum like Gum Arabic. The yellowish wood, though rather coarsely fibrous and said not to be durable, is heavy, close-grained and hard, and takes a fine polish. The leaves smell like anise. From the unripe fruit a sour liquor named Kujak is made, used as a sambal with curries.

The Bael-fruit or *Egle marmelos*, Corr., (Maja Malay, Mojo Javanese, the Slijm-appel-boom of the Dutch) has a world-wide reputation as a remedy for dysentery and diarrhœa. It is a tree from 30 to 40 feet high, much cultivated on account of the many medicinal qualities attributed to the fruit. It is thorny and leaf-shedding, with thick, greyish, smooth bark, and rather large, white, poor flowers; fruit woody, varied in shape, smooth, with

10-15 cells each containing 6-10 oblong woolly seeds embedded in a tenacious shiny yellowish pulp, very agreeable in flavour and fragrant. It is supposed to be indigenous in India, on the slopes of the Himalayas up to 3,500 feet. The wild fruit is said to be small, hard and devoid of fragrance. It is the unripe or half ripe fruit which is the efficacious remedy in dysentery and all cases of irritation of the mucous membrane of the stomach and bowels. It may be useful to give the prescription. "The unripe fruit is cut into small slices and dried, and in this state is used in the form of decoction, prepared with two ounces of the dried fruit and a pint of water. The mixture is to be gently simmered down to one-fourth, and of this the dose must depend on the attendant circumstances of the case. In bad cases of diarrhoea and dysentery three table-spoonsful are to be taken every two or three hours; in milder cases the like quantity three or four times a day; and in mild cases of irritation two or three times a day will be sufficient." (Pereira, "Materia Medica." Vol. II., pt. 2, p. 549.) Sir W. Jones observes of it that "it is nutritious, warm, cathartic; in taste delicious, in fragrance exquisite; its aperient and detersive quality, and its efficacy in removing habitual costiveness, have been proved by constant experience."\* A sort of sherbet is prepared from it with tamarind juice, beneficial in fevers and inflammatory affections attended with thirst. A jelly and a preserve are made of the ripe fruit with sugar, and are used in cases of habitual costiveness and irritation of the stomach. The glutinous mucus surrounding the seeds is used by painters as a size and varnish, and, according to Royle, is an excellent addition to mortar, especially in well-digging.

- *Triphasia trifoliata* DC., (Javanese Jeroh kingkit) a low-sized tree with small oblong red fruits and very fragrant flowers; said to be wild in various places in Malaysia, but is far better known as an ornamental shrub in the gardens about Penang.

The Durian so widely known and so much the subject of animadversion from Europeans on account of its odour, may be

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\* Quoted by Ainslie in his "Materia Indica," II. p. 189.



called *the* fruit of Malaysia. It is said that all attempts to cultivate it in India or tropical America have failed. It is most abundant in Java, Sumatra, the Peninsula and Siam, where it is mostly in cultivation, though said to occur in a wild state; extending to the Sulu Archipelago, but not further into the Philippines (though Crawford says the contrary). It is rather curious to trace the different opinions about the offensive odour which, like all the Sterculiads, is emitted from the rind of the fruit. Rumphius and Valentyn state that in their time it was forbidden by law in the Moluccas to throw them near any public path. In the "Histoire des Voyages," copied by Lamarck in his Encyclopædia, it is said that the Durian diffuses an excellent odour, but the taste is rather unpleasant being that of fried onions. It is needless to state that the Malays are passionately fond of it, and most Europeans also, after a time. There are at least three varieties, in one of which the aril surrounding the nut is hard and leathery. There is, however, a great difference in the flavour in the same varieties, some being luscious and agreeable, while others are harsh and almost acrid with a large admixture of the odour with the flavour. Only a Malay knows how to choose a good Durian. A preserve or comfiture is made from the pulp which I have tasted but once, and then the flavour of garlic seemed disagreeably predominant.

The AMYGDALACEÆ and ROSACEÆ do not flourish in Malaysia. European fruits cannot be successfully cultivated; but in Java, on the higher slopes and rich volcanic soils of the mountains almost everything can be produced. Thus very good Peaches, Almonds, Cherries, Cherry-laurels and Plums, with Strawberries and Raspberries, have rewarded the toil of the acclimatisers at Pantaran, Buitenzorg, and perhaps the Tengger mountain. The careful Dutch husbandry at Buitenzorg, with the advantages possessed by the Acclimatisation Society's garden, must soon place Java in possession of the fruits and flowers of every country of the world, whether tropical or temperate.

The MYRTACEÆ produce perhaps a larger number of indigenous and introduced fruits in Malaysia than any other order, the

principal of which only can be enumerated. *Bæckia frutescens*, L. (Ujang atap and U. ratab, Malay) extends from Hong Kong and south China over the Philippines and Malaysia. It is a glabrous, heath-like shrub, with twiggy branches, minute linear subulate leaves, and small axillary solitary flowers. The Malays use this plant for many purposes, but more medicinally than as an esculent. It is considered an insecticide. "*Castae Battanae virgines tanquam medicamento abortivo utuntur*" (Junghuhn).

The *Eugenie* or Rose-apples, four in number (*Jambosa domestica*, Rumph., *J. alba*, Rumph., *J. aquæa*, Rumph., and *J. vulgaris*, DC., named respectively by the Malays Jambu-bol, *J. puti* or merah and *J. ayer-mawer*), are fruits well known throughout Malaysia, but little esteemed, for they have scarcely any flavour or juice: the flowers, however, are handsome. Forty-three species are enumerated by Filet, so it is one of the best represented genera in the region. *Syzygium jambolanum* or Juat of Sunda, and Buah-jamblang, Malay; Malaruat, Tagalo; Lumboi, Tagalo and Visayan, is another small tasteless fruit much resembling an olive in appearance. It grows extensively in the western groups of the Philippines, and is the only food of the natives when excessive rains and storms drive them to the mountains. Twenty other species are enumerated by Filet. Three species of *Pimenta* or Allspices (*Pimenta vulgaris*, Lind., *P. officinalis*, Lind., and *P. acris*, Wight) may be mentioned. Though occupying a doubtful position as fruits, they are valuable cultivated plants in all Malaysia. The Guava (*Psidium guayava*, L., Jambu biji or utan, Malay) is too well known to require particularising. It must have been introduced from South America into Malaysia very soon after the entry of Europeans into these countries, for it has become perfectly naturalised. Three species or varieties are enumerated by Rumphius, and therefore are of ancient cultivation. *Rhodomyrtus tomentosa*, DC. (Harendong, Malay) is abundant and widely spread over southern India, Ceylon, Malaysia and northwards to China and Japan; but probably in the latter an escape from cultivation. The berries are eaten and much used as a preserve, having an agreeable flavour. It has already been referred to for the beauty

of its flowers. *Soneratia acida*, L., previously described as the "Willow-tree" of Malaysian rivers, bears a sour fruit used in making curries and chutnee, and called Brambang by the Malays. *Punica granatum*, L., or the Pomegranate (Dalima, the red-flowered D. berrem with double flowers, D. susu with white flowers) will conclude this enumeration of Myrtle fruits.

*Terminalia catappa*, L., a large tree called by the Malays Katapang, is found on the sea-coast in all Malaysia. It is named by Europeans the Indian Almond, but the utterly insignificant kernel certainly renders it unworthy of the name of a fruit; nevertheless it is extensively cultivated for the shade given by its large leaves, and its ornamental character. *Grewia oppositifolia* yields an edible berry hardly worthy of mention, and several other species of different orders having small fruits consumed by the natives are omitted.

*Zizyphus jujuba*, Lamarck, is cultivated everywhere. The fruit is sometimes like an unripe cherry, sometimes like an olive. Burmah and British India seem to be its original abode. The Malays call it Bidara, but in Java the name is Doroh. Latterly another, quite a different tree, is sometimes called the Jujube. This is *Muntingia calabura*, L., a tiliaceous tree from tropical America recently introduced into Malaysia, and already abundant about Manila.

*Morus indica*, L., (Malay, Babesarem), the Indian Mulberry, is cultivated in Java, Celebes, and Amboyna for the sake of its fruit; and for silkworms in Java, in the Lampongs and Bencoolen.

Four species of the Cactus order, viz., *Opuntia cochinillifera*, Mill.; *O. polyantha*, Haw.; *O. tomentosa*, S. Dyck; and *O. dillenii*, Haw., have been introduced into Java for the sake of cochineal culture, and bid fair to become naturalised. Strange to say the Malays of Java call this fruit Juli badak or the Rhinoceros' Ear. The fruits are eaten.

Water-Melons and Rock-Melons in many varieties are of course found in cultivation throughout Malaysia. The Malays

call them Batteka, Mandiki, and Semangka. The Musk Melon is distinguished as Semangka belanda. Though long thought to be indigenous to southern Asia, the fruit is now generally admitted to be of African origin. *Cucumis trigonus*, Roxb., is a common wild species in Asia, extending to Australia. The only absolute difference between it and the wild Melon is that the former has a perennial root, while the Melon is strictly an annual. Most probably all the species are only forms of *C. melo*, and therefore the exclusively African origin of the plant cannot be maintained; for if the Asiatic species may have been an ancient escape from cultivation, this cannot be the case with the Australian ones, which have been found wild in the interior by the first explorers, from New South Wales right round to north-western Australia.

*Carica papaya*, the Papaw tree or Kattesh of the Malays, is found in the whole of Malaysia. The Gulf of Mexico or the West Indies is supposed to be the original habitat; but it is so widely spread in Malaysia that it must have been in cultivation shortly after the advent of Europeans to these regions. The property attributed to the milky juice of rendering meat tender has been much exaggerated, though probably having some foundation in fact. The fruits in Malaysia are small; they are cooked unripe as a vegetable (the seeds being removed), or eaten as a fruit when ripe. The seeds resemble in flavour *Tropæolum majus*, commonly called Nasturtium, a name properly belonging to the Water-Cress.

Of PASSIFLORACEÆ, whose fruit is eaten, the most important are *Passiflora filamentosa*, *pallida*, *lutea*, *coccinea*, *maliformis*, *quadrangularis*, *laurifolia*, *edulis*, *incarnata*, and *serrata*; *Tacsonia mollissima*, *tripartita* and *speciosa*; and the Madagascar shrub called *Paropsia edulis* (Lindley). None of these can be said to be much, if at all, in cultivation in Malaysia.

*Inocarpus edulis* (Gajam, Malay) is found in the Moluccas producing a nut which is cooked and eaten in Java. It is found in a few places in cultivation. *Persea gratissima*, Gaertn., or the

Avocado pear, is a tree of the Laurel family with the highest reputation for medicinal properties, and a husk rich in green oil. It is a native of the West Indies and is only cultivated in Java.

Bread-fruits, Jack-fruits, Champada and Terap or Tarippe, known to botanists as *Artocarpus incisa*, L., *A. blumei*, Tr., *A. elastica*, Reinw., and *A. integrifolia*, L., and to the Malays as Klowei, Sukon and Bendo in Javanese, are cultivated in all Malaya, and from Sumatra to the Marquesas Islands; and this was the case when Europeans first visited these regions. De Candolle regards Bread-fruit as a native of Java and the Moluccas. Its fruit is constituted like the Pine-apple into a spherical fleshy mass, and, like that fruit, the seeds come to nothing. From this he argues, in the extreme eastern islands at least, the great antiquity of its cultivation and probably also its introduction. But, he adds, the number of varieties and facility of propagation by buds and suckers prevent our knowing its history accurately. The large almost palmate-leaved Bread-fruits are very ornamental. The Jack-fruit, called also Nangka, is more generally cultivated, producing immense fruits along the main branches or stem of the tree. A species with smaller fruits which are much better flavoured is the Champada, distinguished by the underside of the leaves being hairy. It is a kind much preferred by the Malays. Finally, the Tarippe or Terap (*Artocarpus elastica*) is a round tree with leaves larger than the preceding, and hairy on both surfaces. The fruits are borne near the end of the branches, and not from the main branches or stem, as in Jack-fruit and Champada. Most persons prefer the Terap as being less tough and leathery and more juicy. The seeds of all the species are roasted like chestnuts and eaten. All yield a kind of gutta.

“The Tampoe or Tampui (*Pierardia dulcis*?) is another very common jungle-fruit, of which but little appears to be known. There are three varieties—Tampoe shelou, Tampoe puti, and Tampoe baraja. The two first-named differ in one having yellow pulp and the other white. The last is a smaller fruit having four internal divisions instead of six, and the pulp is of a bright



chestnut colour. The part eaten is the pulp surrounding the seeds, which is agreeably sub-acid and very refreshing. The pavia-like husks and the seeds are discarded. The tree is 50 or 60 feet high, with dark green poplar-like leaves, and the fruits hang two or three together in lax clusters, the stalks being produced from the older branches. This fruit is eaten in large quantities by the natives; and the pulp, mixed with rice and water and afterwards fermented, affords them an intoxicating drink but little inferior to the toddy prepared from the Cocoa-nut Palm" (Burbidge, "Gardens of the Sun," p. 317). The author refers to Borneo only, but if Tampoe is *Pierardia dulcis*, it occurs in Java and Sumatra.

*Emblica officinalis*, Gaertn., (Buah malaka and Kemloco, Malay), is a sour-fruited species of the EUPHORBIACEÆ, which grows abundantly round Malacca; Malaka is one of the native names both in Sundanese and in Malay. The tree is ornamental enough with its feathery distichous leaves; but the green fruits seemed to my taste too sour to be palatable. The genus *Garcinia* has many species, perhaps ten or twelve, in Malaysia which may be said to be the head-quarters of the well-known Mangosteen, a name derived from the Malay mangis, which with little modification is found in all Malayan dialects. The fruit is found throughout the equatorial region as far as 14° N. and S. latitude; but Mindanao is the only island of the Philippines in which it succeeds. For those who do not know the fruit it may be described as one of the most luscious, while the tree is particularly ornamental. In July, August, and September it is abundant in the markets and cheap. Another fruit belonging to the same family is *Stalagmites dulcis*, Camb., the Mundu of Java and Gledok or Gertok-pantok of Sundanese Malay, an evergreen tree 40 to 60 feet high, frequent in the forests up to 3000 feet. It yields a superior quality of gamboge, fruiting in February, and bearing a four-celled berry about an inch in diameter. This must not be confounded with *Garcinia dulcis*, Kz., an equally common tree bearing a berry the size of a lime, smooth, bright yellow, with from one to five large seeds in a yellow fleshy pulp. In the same

order we find *Calophyllum inophyllum*, L., a tropical species which is widely spread in Asia, with a globular fruit the size of a plum. It is equally common in tropical Australia. It grows close to the sea-margin, and being a tree of splendid foliage and handsome white flowers, is a conspicuous ornament. The fruit however is not of much value. The Malay name is Betau. Amongst the GUTTIFERÆ there are other fruit-trees of interest of which want of space compels the omission. One of the MELIACEÆ calls for a little remark, and that is *Sandoricum indicum*, Cav., the Sattul of the Malays, found throughout the region. It is valued for a yellow apple-like berry containing five nuts; but it is not very palatable, being somewhat like a sour Mangosteen. Another much more important member of the order is *Lansium domesticum*, or Langsat, Lanse, or Ayer-ayer, a fruit growing in clusters, of yellowish colour, containing a tenacious juicy aril. It has a pleasant, sweetish flavour, much esteemed by the Malays.

The order SAPINDACEÆ gives a good many useful and esculent members. First of all is the Rambutan which is the Malay name for a fruit cultivated abundantly throughout Malaysia on a tree of medium size. It is peculiar to the region, like the Durian and Mangosteen. Like the Langsat the edible portion is the aril. This is semi-transparent and of agreeable flavour; but small in quantity, and rather too tenacious to be pleasant eating. The husk is scarlet in colour, covered with a kind of shaggy coat, and has a decidedly attractive appearance as seen in some of the crowded orchards around Penang. The name is derived from the Malay word for hair. The botanical name is *Nephelium lappaceum*, L. The wood has not much solidity, and therefore is little used. What the Malays call Rambutan-utan is *Xerospermum noronhianum*, Bl., a shrubby tree about 20 feet high, with a compact durable wood much used in carpentering. *Lansium domesticum*, Bl., is thought to be the finest fruit in the Peninsula, or at any rate ranking next to the Mangosteen. The fruit lies in clusters on the trunk and branches, being of a moderate size, and having the edible part inside of a tough buff-coloured husk or rind. The Rambi is another variety of the same tree. When the Langsat,

Rambi, or Duku is cultivated in richly manured ground, the fruits have comparatively thin and small seeds or nuts, while the edible part is much augmented. The Li-chi (*Nephelium litchi*) does not grow in Malaysia, though it finds its way in quantities from south China to Singapore, and is seen abundantly in the markets in July and August. This fruit appears to me to be the most palatable of any in the East, deserving the saying of Warren Hastings that it was almost the only fruit which deserved to be regretted even amidst the plenty of Covent Garden.

*Anacardium occidentale*, L., the Jambu-monjet of Malays and the Cashew-nut of English, is a native of South America, which is quite naturalised in Malaysia, so that one sees the fruit in all the markets about the month of April. This has a very peculiar appearance, being like a yellow or reddish fig, bearing at its base a kidney-shaped seed. The sweet kernel inside is protected by a husk saturated with an indescribably acrid oil, which corrodes iron rapidly and marks linen with ineffaceable stains. The Pomme d'Acajou, as the French call it, though attractive in appearance and sweet to the taste, leaves a painful irritation on the throat, so that they are seldom eaten raw. The green fruits are very astringent, and serve to tan leather as well as to fix dyes in fabrics. The ripe fruit used as a preserve is excellent and wholesome. The nut is parched on a pan, and so is used as a substitute for chocolate or as a means for its adulteration. The Malays call the nut Casoe.

*Semecarpus anacardium*, L., (Rengas meira, Malay), or the Marking-nut, has become naturalised in Malaysia, and bears racemes of what look like small Pomes d'Acajou the ripe fruit of which is eaten. The mature corolla and receptacle are fleshy and of a sweetish sour taste, but producing, unless cooked, much subsequent irritation of the throat. The kernel of the nut can be eaten, but scarcely with safety uncooked, for the juice contains an acrid, viscid oil, used as an escharotic, which leaves a mark for life on the skin, and often intractable and painful sores. It is used as a medicine for elephants, but in excessive doses renders them

furious. The pollen of the flowers is very narcotic and irritating, affecting some people to a dangerous extent, since by only going near the flowers they become stupefied and their limbs swollen. It is considered dangerous to cut down the tree or even to work upon the wood; in fact everything about this tree is so poisonous that it seems to realise the exaggerated fables about the Upas-tree. *Semecarpus cassuvium*, Spreng., (Daun sako, Malay), the Malacca or Marsh-nut of the French, now naturalised in the Moluccas, Banda and Ceram, from the Antilles, has similar properties, and is said to be a brain stimulant, giving memory and wit to fools like the elixir of the Arab doctor Mésué.

After all that has been written about the well-known Mango (*Mangifera indica*, L., and Manga, Malay) a mere reference will suffice in this essay. The species are about 14, including *M. indica* and its many cultivated varieties, *M. fetida*, Lour., the Horse Mango of the Malays, of which natives of Malaysia and India are very fond notwithstanding its offensive odour and seriously deleterious qualities. The genus is entirely Malayan; the best are cultivated in the Philippines and in Java, while they seem unable to grow good fruit in the Malay Peninsula. There is a considerable export of Mangoes from Manila, which proves the esteem in which they are held in the neighbouring countries, but I have never seen fruit superior to that which I obtained in Java.

*Bouea gandaria*, Bl., the Gandaria of the Malays is a kind of Mango; the fruits are esteemed by the natives, and the young leaves are eaten with rice in Java and Borneo. *Dracontomelon mangiferum*, Bl., or Buah rau, known to most botanists as *Poupartia*, bears a kind of edible Mango eaten in the Moluccas. This is the Dragon-tree (Drakenboom) of Valentyn, who says that the fruit when newly gathered is highly refreshing. *Evia acida*, Bl., is the Kedondong of the Javanese and the Pomme de Cythère of the French, which is cultivated and almost naturalised in Malaysia though probably introduced from the Society, Friendly, or Fiji Islands. It is like a large plum and contains a stone, but coloured like an apple, and covered with long hooked bristles.

The flavour resembles that of the Pine-apple. This is the Hog-plum or Tahiti Apple, better known to botanists under the name of *Spondias dulcis*.

Mata kuching or Cat's-eye, the well-known Jungle-nut, growing in close racemes, consisting of a triangular drupe containing a single bony one-seeded nut with an opalescent kernel from which the name Cat's-eye is derived. This is *Canarium commune*, L., belonging to the BURSERACEÆ, an order much resembling the Orange tribe, but whose fruit has a shell which splits into valve-like segments. The three-cornered nuts are eaten safely when cooked, and an oil obtained from them which is eaten when fresh, and burned when stale. Myrrh and frankincense are also derived from the gum. There are several species of *Canarium*, a name which seems to be derived from the Malay word Kanari, the Java almond. The resin is called Gum-elemi in India. Another species is called Kanari minjak by the Malays, and another in the Moluccas Kanaritam and Damar-itam, and Damar gala-gala; while, according to Bisschop Grevelink, *Canarium dichotomum*, Miquel, is the species to which the name of Damar mata kuching is applied. In the same order is *Protium javanicum*, Burm., the Tingulong of the Malays, a stout tree of medium height which grows in Java and the Moluccas. The fruit, though edible, is but little esteemed, yet it yields an aromatic essential oil with many uses.

The large order of RUBIACEÆ scarcely furnishes any fruits of importance, and of these none are known in Malaysia either indigenous or cultivated. *Sarcocephalus* is a genus well represented in the province, but the fruit-bearing Native Peach of Africa, *S. esculentus*, has not come into use. Two species of *Morinda*, which are very abundant on the coast (*M. citrifolia*, and *persicifolia*), one of which is widespread in Australia and serves as a fruit for the natives, are common.

Amongst the SAPOTACEÆ *Achras sapota*, L., or the Sapodilla Plum, (in Malay Chicos, Javanese Sawo) is extensively cultivated in and around Malacca, though it is a plant of West Indian or Central American origin. It is a tall straight tree without knots



or branches for 20 feet or so ; and the head then spreads into small branches ; the bark dark grey, full of cracks ; fruit oblong, covered with a thick brownish-grey rind, the flesh is yellow as a carrot, with two stones like almonds, very fragrant. The taste is relished exceedingly by the Malays ; but is like brown sugar. When fresh gathered it is extremely acrid, and a white clammy juice exudes from the broken skin. This is a true Gutta and very adhesive. The fruit is then hard, but by being kept it becomes soft and sweet like a medlar, losing its astringency, a process hastened by burying in sand. The seeds are in the centre. The Chicos are highly esteemed throughout Malaysia. It is best known in the Philippines where probably it was first introduced. The species called the Naseberry has fruit in shape and size like a Bergamot Pear. This is *Achras zapotilla*, *Achras* being the name of the wild Pear, and the specific name is from the Mexican Zapotl. It is a wonder that Europeans have not introduced *A. mammosa*, the Mammy Apple or American Marmalade, which is so highly esteemed in the West Indies. It bears a large, oval, brownish fruit, with a thick russet-coloured pulp called Natural Marmalade, and very luscious to the taste. In Malacca it is said that a Sapotilla tree is one of the most profitable grown, as one will produce fruit of the value of £50 in a season. The order of SAPOTACEÆ has some indigenous representatives in Malaysia, including species of *Isonandra* and *Bassia*, both of which are Guttas, producing valuable varieties of gutta percha. *Isonandra gutta*, Hook., Balam tambaga of the Malays, besides other species of that genus and of *Bassia*, are met with in the Peninsula, Sumatra, Borneo, &c. ; but the trees are being destroyed by the natives who collect the juice in a most wasteful manner.

*Diospyros kaki*, the Persimmon or Date-plum, the Caju Sawu of Java, is a tree which grows abundantly on the southern coasts of the island of Bali, and in the western and low lands of Java. The Sawu loves a humid soil near the beach, and seems to grow especially well in the islands of the Bay of Batavia, where the trunk acquires considerable thickness ; but Bali and Java seem to be the only parts of Malaysia where it thrives.

Finally, though somewhat out of place, *Averrhoa carambola* and *A. bilimbi*, the Carambola trees of the English and the Blimbing and Bainan of the Malays, bear an odd-looking winged green fruit, containing an acid pulp which is somewhat insipid; but the trees themselves are very ornamental.

In this list some omissions have been necessary to bring it within reasonable limits; but none of the more important fruits have been passed over. The different varieties of Plantains and Bananas would require a separate treatise, while the Cocoa-nuts are identified more with the vegetable products. Nanas, as the Malays call the Pine-apples (*Ananassa sativa*, Lindl.), is of course widely diffused amongst them. Their name is identical with the Brazilian one, obtained through the Portuguese, who introduced it into India in 1594. Altogether it is not a favourite fruit in Malaysia, since it is certainly not seen in its perfection in those regions. A peculiar variety introduced by Sir Hugh Low is commonly seen as an ornament upon the table. It is called the Hen and Chickens on account of the odd mode of growth which it manifests. There is a tall conical central pine, and, at its base, four or five small pines spring forth, but the fruit is for ornament only.

HORTICULTURE.—The English and Dutch colonists have always been remarkable for the cultivation of flowering plants. This peculiarity has resulted in the ornamental or neat and beautiful appearance which roads and streets, gardens and enclosures invariably bear in the colonies of the above nations. The taste thus manifested is of ancient date; but it has grown, and probably has never previously attained such activity in the cultivation of native flowers, and the introduction of new ones as at present. Yet in the Straits Settlements and Dutch colonies acclimatisation has not progressed as it should have done. Persons who possess every advantage, and might have gardens of pre-eminent variety and beauty, confine their attention to a few common and easily grown species, so that one sees the same things over and over again. Masses of *Hibiscus rosa-sinensis*,

*Poinciana regia* and *pulcherrima*, *Duranta plumieri*, *Bougainvillæa glabra*, *Plumieria acutifolia*, and the same *Clerodendrons* meet one with tiresome monotony on every side, and nothing else. Splendid exotics are within the reach of every one without much trouble or expense, since the work has already been begun by a few. I made many lists of the flowers in cultivation in the gardens of the Straits Settlements especially, and I was equally astonished and disappointed to find how meagre the catalogues were, and at the endless repetition of the same plants. Combining these together, the following list will give an idea of the floral adornments of the gardens of Malasia. I shall take the opportunity of making a few comments on some of the species as they occur. Species marked \* are naturalised. Where the species of an order are few, several orders are grouped together.

*Nymphæa lotus*, *N. pubescens*, *N. stellata*, and *Nelumbium speciosum* are found in all gardens where there are ornamental waters.

*Magnolia fuscata*, *M. pumila*, and *Michelia champaca* are in most gardens cultivated for their fragrance. *Bixa orellana*, *Pittosporum undulatum*, *Portulaca grandiflora*, *Garcinia* (many species), *Adenandra dumosa*, *Camellia japonica*, *Abutilon venosum*, *Hibiscus rosa-sinensis*, *Stigmaphyllon ciliatum*, *Canarium commune*, *Melia composita*.

LEGUMINOSÆ.—*Clitoria ternatea*, *Cassia fistula*, *Poinciana pulcherrima* and *P. regia*, *Ceratonia siliqua*, *Bauhinia* (many species), *Amherstia nobilis*. [This last forms one of the most attractive things in flowering trees that is possessed by the East. Don is almost justified in saying that when in foliage and blossom it is the most superb object imaginable, not surpassed by any plant in the world. It is probably a native of Burmah, and was found originally in the garden of a Buddhist monastery. Yet its native place is still uncertain. It is an unarmed tree some 40 feet high, with large abruptly pinnate narrow leaves with six to eight pairs of leaflets, and long pendulous drooping terminal racemes of showy flowers. These are very handsome, of fine

vermilion colour diversified with yellow spots, and a soft velvety appearance. The bracts are also highly coloured and persistent. The latter are a pair, one and a half inches long, broadly lanceolate and crimson, the whole forming long drooping racemes at the ends of the branches]. Also *Luccena glauca*, *Inga dulcis*.

*Hydrangea japonica*, *Bryophyllum calycinum*, *Rhodoleia championi*, *Combretum grandiflorum*, *Rhodamnia trinervis*, *Rhodomyrtus tomentosa*, *Lawsonia inermis*, *Lagerstrœmia floribunda*, *L. indica*, *L. regince*, *Punica granatum* (Pomegranate, white and red varieties), *Turnera trioniiflora*, *Passiflora* (many species), *Trichosanthes laciniosa*, *Begonia* (many species), *Opuntia* (many species) and other Cactaceæ.

*Panax fruticosum*, *Aucuba japonica*, *Lonicera chinensis* (the Chinese Honeysuckle), *Rondeletia odorata*, *Gardenia* (many species), *Ixora alba*, *I. coccinea*, *I. rosea*, and others.

COMPOSITÆ.—*Helianthus tuberosus*, *H. annuus*, *Chrysanthemum sinense*, *Eupatorium glandulosum*, *Gaillardia bicolor*, *Coreopsis coronata*, *Dahlia excelsa* (Tree Dahlia) and other species, \* *Zinnia multiflora*, *Z. elegans* and other species, *Cichorium intybus*, *Rudbeckia laciniata*, *R. hirta*, *R. columnaris*, *Silphium terebinthaceum*, *Craspedia glauca*, *Centaurea depressa*, *Ageratum mexicanum*, *Farfugium grande*, *Tagetes patula*, *T. erecta*, *Helichrysum* (many species), *Cineraria sinensis* and other species.

*Rhododendron javanicum*, *Plumbago capensis*, *P. rosea*, *Ardisia* (many species), *Jasminum* (many species).

APOCYNACEÆ.—*Allamanda aubletii*, *A. cathartica*, *A. nobilis*, *A. schottii*, *A. neriifolia*, *A. violacea*, *Ochrosia elliptica*, *Wrightia coccinea*, *Echites* sp., *Mandevilla suaveolens*, *Willughbeia edulis*, *Cerbera odollam*, *Kopsia fruticosa*, *Vinca rosea*, *Plumieria acutifolia* (commonly called the Frangipanni, which it is not; planted in all cemeteries), *Tabernœmontana coronaria*, *Nerium oleander*, *Beaumontia multiflora*.

*Calotropis gigantea*, *Stephanotis floribunda*, *Pergularia odoratissima*, *Hoya carnosa* (and other species), *Heliotropium peruvianum*, *Ipomœa* (many species both from the jungle and exotic), *Jacquemontia violacea*, and *Porana volubilis* or the Bridal Wreath, a climbing shrub bearing dense racemes of small white delicate or waxy-looking flowers. This is a very beautiful species, a native of Burmah, but much cultivated in Malaysia. The closely packed racemes of white flowers, though small are exceedingly attractive.

*Solanum jasminoides* and many other species, *Solandra grandiflora*, *Datura* sp., *Brugmansia arborea* and other species, *Brunfelsia eximia*, *Habrothamnus newellii*, *Juanulloa mexicana*, *Cestrum candidum*, *Angelonia floribunda* and others, *Pentstemon* (many species), *Russelia juncea* (the Corallitos of the Spaniards; this has become quite a part of the native flora in Borneo and the Philippines), *Torenia asiatica*, *T. baillonia*, and *T. polygonoides*.

The climate being exactly suited to the GESNERACEÆ, which flower easily in the open air though requiring shade, they are well represented, but not as extensively found in every garden as they should be. *Gloxinia* with its many varieties, *Achimenes cherita* and its varieties, *Tydea picta* and varieties, *Gesnera cinnabarina*, *G. oxoniensis*, *G. refulgens*, *G. zebrina*, *Cyrtandra glabra*, *Cyrtodeira fulgida*, *Æschynanthus* (all of the species which the jungle produces).

BIGNONIACEÆ.—*Bignonia venusta*, *B. grandiflora*, *B. radicans* and other species, *Tecoma australis*, *T. capensis*, *T. jasminoides*, *T. tweediana*; the latter I saw only in gardens in Menado, Celebes.

ACANTHACEÆ.—*Thunbergia alata*, *T. grandiflora*, *T. harrisii*, *T. laurifolia*, *Meyenia erecta*, *M. vogeliana*, *Sanchezia nobilis*, \* *Barleria cœrulea* and other species, *Crossandra infundibuliformis*, *Asystasia coromandeliana*, *Eranthemum* (many species), *Aphelandra cristata*, *A. fascinator*, *Justicia coccinea*, *Rhinacanthus communis*, *Cyrtanthera pohliana*, *Fittonia argyroneura*, *Graptophyllum hortense*.

VERBENIACEÆ.—*Lantana* (many species), \* *Stachytarpheta indica*, *S. jamaicensis*, *S. mutabilis*, *Duranta plumieri* (both the blue and white varieties), *Petrœa volubilis*, *Clerodendron* (many species).



LABIATÆ.—*Coleus* (many species), *Salvia coccinea*, *S. barbata* and other species.

NYCTAGINÆ.—*Mirabilis jalapa*, *Bougainvillæa glabra*.

EUPHORBIACÆ.—*Acalypha marginata*, *A. indica* and other species, *Croton* (many species), *Manihot utilissima*, *Jatropha curcas*, *J. multifida*, *Euphorbia splendens*, *E. (Poinsettia) pulcherrima*.

Amongst the CONIFERÆ the usual Pines, Cypresses, and other genera commonly in cultivation are met with, the favourites being *Cupressus lignum-vitæ*, and *Cryptomeria japonica*.

### ENDOGENS.

*Canna indica* and other species, *Maranta* (many species, in the Straits as elsewhere great favourites amongst the plants cultivated for their foliage), *Alpinia nutans*, *Costus speciosus*, *Heliconia bicolor*, *H. sanguinea* (with large magnificently coloured flowers closely allied to Banana), *Urania speciosa* or the Traveller's Tree, as well as *Strelitzia angustata*, which it somewhat resembles in habit, are much in cultivation round Singapore.

Having dealt with the Orchids we may pass by the Bromeliads, of which a good many are in cultivation. Amongst the AROIDEÆ many species of *Alocasia* and *Caladium* are cultivated for their foliage, *Richardia æthiopica*.

LILIACÆ.—*Yucca aloifolia*, *Y. brevifolia*, *Y. glaucescens*, *Lilium longiflorum*, *L. washingtonianum*, *Agapanthus umbellatus*, *Blandfordia cunninghamii*, *B. flammea*, *B. nobilis*, *Aloe carinata*, *Dianella cærulea*, *D. ensifolia*, *Cordylina albicans*, *C. ensifolia*, *Dracæna* (many species), *Tradescantia discolor*.

AMARYLLIDÆ.—*Clivia nobilis*, *Imantophyllum miniatum*, *Doryanthes excelsa*, *D. palmerii*, *Agave americana*, *Fourcroya gigantea*, *Amaryllis belladonna*, *A. hippeastrum*, *A. ignescens*, *Zephyranthes rosea*, *Vallota purpurea*, *Eucharis amazonica*,

*Alstroemeria aurea*, *A. braziliensis*, *Crinum amabile*, *C. asiaticum*, *C. ornatum*, *C. pedunculatum*, *Eurycles australis*, *E. cunninghamii*, *Pancratium biflorum*, *P. malabaricum*, *P. speciosum*.

Ferns and Lycopods are as extensively cultivated in the Straits Settlements as Orchids, and the number and variety of indigenous kinds is as great as in any part of the world, so that this branch of horticulture is very popular and successful.

SEED-PLANTS.--Plants cultivated for their seeds would make a very extensive list if we include the cereals, such as *Triticum*, *Panicum*, *Setaria*, *Sorghum*, *Zea mays*, *Oryza*, and the legumes such as the Peas (*Pisum arvense*, *sativum*, &c.), the Beans (*Phaseolus*), Pigeon-pea (*Cajanus indicus*), the Soy (*Dolichos soja*), Buckwheat (*Polygonum fagopyrum*), &c. In this essay no more can be done than to enumerate a few of the most common.

*Coffea arabica* cultivated extensively in Java, but more sparingly in all the other islands. Strange to say, Blanco thought it indigenous in the Philippines. It is a native of Abyssinia.

*Theobroma cacao* or Cocoa is extensively cultivated all over Malaysia.

*Gossypium herbaceum*, L., Algodonero, a Spanish word which is in use by all the Philippine Indians; in nearly all the Malay dialects Kapas and Kabu-kabu; in Bengali Kapase; in Hindostanee Kapas, all derived from the Sanskrit word Karpassi; Arabic Kutn whence Coton and probably Algodon; Chinese (Punti) Min; Mandarin Mien; Japanese Wata and Momen. Probably its original habitat was Malaysia. Two exhaustive works have appeared on the subject lately in Italy, one by Parlatore\* and the other by Todaro.† The former admits seven well-known species and two doubtful, while Todaro counts

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\* Monogr. delle specie d. Cotoni, 4to. Florence, 1866.

† Relaz. della coltura dei Cotini in Italia con monographia del genere *Gossypium*. Svo. Roma, 1877.

fifty-four, only two of which are doubtful, reckoning as species forms which originated in cultivation and are permanently preserved. *G. herbaceum* is the species most cultivated in the United States, *G. indicum* in China and Japan; but these determinations are doubtful. The natives of all the East from India to Japan depend upon it as one of the great staples of agriculture.

*Papaver somniferum* derived from *P. setigerum* which is wild on the shores of the Mediterranean; cultivated from the most ancient times.

Mere mention can only be made of the following: *Sesamum indicum* cultivated for oil, Nutmeg (*Myristica fragrans*), *Aleurites moluccana* cultivated for the oil in its seeds, *Jatropha curcas* yielding a medicinal oil used also in lamps.

CULTIVATED ROOTS.—*Colocasia antiquorum* is cultivated for the edible rhizome and the swelled lower portion of the stem. The leaf-stalks and young leaves are also eaten as a vegetable when cooked. It belongs to the flora of south Asia, but its use has spread over the warmer islands of the Pacific, the West Indies and tropical America. *Alocasia macrorrhiza*, Schott, is another of the esculent aroids, less frequently cultivated than the first-named; but in the same manner, and nearly in the same countries. The rhizomes attain the length of a man's arm. They must be cooked until all bitterness is removed, or they are poisonous. (De Candolle). "The Malay names of the first-named species are kelady, tallus, tallas, tales or taloes, from which perhaps comes the well-known name of the Otahitans and New Zealanders—tallo or tarro, dalo in the Fiji Islands. The Japanese have a totally distinct name, imo, which shows an existence of long duration either indigenous or cultivated."\* *Alocasia indica*, Schott, with three varieties mentioned by De Candolle, is cultivated equally with the former.

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\* De Candolle, "Origin of Cultivated Plants," p. 74.

*Ipomœa batatas*, L., is the well-known sweet potato belonging to the order of CONVULVULACEÆ, largely cultivated amongst the Malays, likewise in all countries within or near the tropics. The Malay name is Ubi, which is also applied to the common potato; Keledek is the common Malay name for the sweet potato. The origin of this plant, universally cultivated in the tropics, is extremely doubtful. The whole question is given in De Candolle *op. cit.* He gives the Chinese name as Chu; in Puntî I find it is Fan-shu; in Japanese it is called Satsuma-imo, and common potatoes Riukiu-imo.

LICHENS.—In a moist climate and amid such shady forests as those of Malaysia it may be readily imagined how rich the harvest of lichens ought to be; but very little has been done towards their determination. I made no collection except a few specimens which have not been determined. I give here therefore the list of genera of those enumerated by Nylander and Crombie from Vol. XX., p. 48, of the "Journal of the Linnean Society," (Botany), London. These were collected in the Straits Settlements by Dr. Maingay about twenty years previously, or between 1861 and 1865. Amongst them was a number of new species.

Family Collemacei: *Collema* 2 species, *Dichodium* 1, *Leplogium* 2.

Fam. Lichenacei: *Ramalina* 1, *Usnea* 2, *Parmelia* 10, *Physcia* 1, *Pyxine* 2, *Pannaria* 1, *Lecanora* 5, *Thelotrema* 2, *Ascidium* 1, *Coccocarpia* 5, *Lecidea* 10, *Gyrostomum* 1, *Graphis* 8, *Medusula* 1, *Opegrapha* 1, *Arthonia* 4, *Glyphis* 4, *Chiodecton* 1, *Verrucaria* 15, *Trypethelium* 4, *Endococcus* 1.

This collection can only be considered as an instalment of the lichen flora of the region, but it is interesting as affording a good specimen of its character. It will be observed also that amongst them common and well-known species of commercial value such as *Parmelia tinctorum*, Despr., and other world-wide species were found. The largest number of species came from about Malacca and Singapore.

FUNGI.—It is impossible to give any complete or satisfactory account of the fungi of the Malayan region. A little has been done here and there, but nothing like a systematic collection of the whole region. Dr. Hooker has collected in the Himalayas, Junghuhn in Java, a little is known of the Philippines and some portions of the Indian Archipelago, but the knowledge is too fragmentary to be of much service. During my travels I was able to make a few observations on the species seen in the jungle, and I have a very few drawings of some of the more perishable kinds. The result of all is that no more can be offered here than a few general and fragmentary observations.

Although heat and humidity influence all kinds of vegetation, yet heat, says Mr. Cooke, seems to exert a less, and humidity a greater influence on fungi than on other plants.\* Moisture and cultivation affect their growth in most civilised countries; but in the Malayan region the great influencing causes are moisture, shade, and decaying vegetation. In Java Junghuhn found them most prolific at an elevation of 3,000 to 5,000 feet, and Dr. Hooker remarked that they were most abundant at 7,000 to 8,000 feet above sea-level.

In tropical countries Agarics are not so numerous as *Polyporus*, *Lenzites*, &c. *Coprinus* is equally common everywhere. The genus *Marasmius* is most abundant in the tropics, which is also the principal centre of *Lentinus* and *Lenzites*. The *Polypori* living for the most part upon trees present the most varied forms, while many species are noticed of *Hexagona*, *Favolus*, and *Laschia*. Travellers will not fail to notice the great abundance of species of *Hirneola*, especially *H. polytricha*, Fries, on logs and fallen timber. It is largely collected by the Chinese and sold in the markets. The species is so abundant in Malaysia, and is so valued in China that a trade might be easily established. *H. auris-judæ* is also common. This is the species which is exported to China from

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\* "Fungi, their Nature, Influence, and Uses." By M. C. Cooke. London, 1875.



Tahiti. There are many other edible species used by both Chinese and Malays. The well known *Polyporus lucidus* is as common as in Europe, and one constantly meets with *P. cinnabarinus*, Fries, with its brilliant vermilion hymenium. *Schizophyllum commune* is found almost everywhere. Probably there is no plant, and certainly no fungus, so extensively diffused over the world. The Phalloidei are pretty numerous, and as usual conspicuous for their form and colour. Two or three species of *Morchella* are used for food and perhaps the large truffle-like *Mylitta*.

Java has been the best explored for fungi where Junghuhn records 117 species in 40 genera, Nees von Esenbeck and Blume 11 species in 3 genera, and Zollinger and Moritzi 31 species in 20 genera, making a total of 159 species, of which 47 belong to *Polyporus*. L evill e added 87 species, making a total of 246 species. The fungi of Sumatra, Borneo, and other islands are partly the same and partly allied, but of a similar tropical character. Cooke is my authority for these figures who quotes Junghuhn, "Premissa in Floram Crypt. Jav e," and Zollinger, "Fungi Archipelagi Malaijo Neerlandici novi."

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#### EXPLANATION OF PLATES.

- Fig. 1. Fruit of *Dipterocarpus* sp.  
 Fig. 2. *Dryobalanops aromatica*, Steud.  
 Fig. 3. Ditto, long section of fruit.  
 Fig. 4. Fruit of *Quercus angustata*, Bl.  
 Fig. 5. ,, *Q. glaberrima*, Bl.  
 Fig. 6. ,, *Q. placentaria*, Bl.  
 Fig. 7. ,, *Q. elegans*, Bl.  
 Fig. 8. ,, *Q. rotundata*, Bl.  
 Fig. 9. ,, *Q. induta*, Bl.  
 Figs. 10-11. ,, *Q. costata*, Bl.  
 Fig. 12. ,, *Q. platycarpa*, Bl.

EXPLANATION OF PLATES—*continued*:

- Fig. 13. Fruit of *Q. daphnoidea*, Bl.  
Fig. 14. „ *Q. gemelliflora*, Bl.  
Figs. 15-16. „ *Q. turbinata*, Bl.  
Fig. 17. „ *Q. pallida*, Bl.  
Fig. 18. „ *Q. sp.*  
Fig. 19. „ *Q. pruinosa*, Bl.  
Fig. 20. „ *Q. sundaica*, Bl.  
Fig. 21. „ *Q. pseudomolucca*, Bl.  
Fig. 22. *Eugeissona triste*, Griff.  
Fig. 23. Fruit of *Eugeissona triste*, Griff.  
Fig. 24. *Licuala peltata*, Griff.  
Fig. 25. *Ataccia cristata*, Kunth.  
Fig. 26. *Cypripedium sandermanum*, Reichenb.  
Fig. 27. *Uropedium lindenii*, Lindl.  
Fig. 28. *Cypripedium caudatum*, Hartw.  
Fig. 29. *Medinilla magnifica*, Lindl.